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STUTTERING: II. A REVIEW AND INTEGRATION OF PHYSIOLOGICAL DATA

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I. INTRODUCTION

Physiological investigations in the field of stuttering have been extensive. In addition to their extended character, in general they have been so overlaid with assumptions that very frequently the actual recorded datum is difficult to separate from interpretation. Mere gathering and enumerating of findings, no matter how interesting, of course is not science. Although the speech pathologist is interested in crude data, he is equally if not more interested in ascertaining relationships between events. However, the making of assumptions is fruitful only insofar as interpretations are derived from and continuous with the events to which they are revelant. To take an example, if an investigator makes a statement that the stutterer has a disordered nervous system he must unequivocally demonstrate that the organism is different in some essential way from that of the normal speaker. If he cannot do this, except by presenting the stuttering behavior itself as proof, his statement may hardly be regarded as a valid hypothesis, and perhaps not even as a meaningful one.

The data of stuttering are often of a seemingly discrete, disparate, rather discrepant character. Apparently, certain findings are entirely in opposition. But even with these surface contradictions the question has been asked: "We know that behavior does not occur in haphazard manner; these jig-saw pieces of knowledge on stuttering in some way must dove-tail together. Why is it, then, that the factual data of stuttering have not been unified?"

The answer probably lies in the direction of principles. No principles of behavior have been applied to stuttering which are sufficiently basic to embrace its various aspects. Although this writer makes no pretence of having integrated all the known physiological data of stuttering, it is the aim of this paper to show that it can probably be done if fundamental principles of behavior are applied.

In an earlier paper (43) the present writer surveyed the biochemical literature in the field of stuttering. Analysis

showed that differences between stutterers and non-stutterers in this regard could be legitimately explained upon a basis of increased muscular activity, whether smooth or skeletal. The general basis for the conclusion was that affect and so-called overt muscular work produce similar or identical shifts in biochemical constituents.[1] When considering the response the two behaviors are basically reducible to the same phenomenon: elevated activity of particular organisms while behaving in particular situations.

Although only too frequently physiological reaction and psychological behavior are confused, little difficulty is encountered in differentiating so-called motor abilities from physiological activities. Manipulative, or motor, abilities are learned and thus cannot properly be classed as physiological. However, the area of the borderline actions present the analytic problems, i.e., those reactions which fall into S→R categories which are typically neither physiological nor psychological, such as conditioned sinus arrhythmia or vasomotor changes.

Pure physiology conforms to strict structure-function activity; no differential responses appear. The particular organ functions invariably in accordance with its structure and the biochemical conditions which obtain at the moment of the adequate stimulus. An example of physiological reaction from Penfield and Erickson (80, 48) will clarify this point. They report that stimulation of the Rolandic cortex (pre-central gyrus) within the face zone just above the so-called swallowing area, in either hemisphere, results in a long-drawn-out expiratory vowel sound. If stimulation is continued the subject may stop to draw a breath and then continue. "No words result—there is no attempt at enunciation. Vocalization is no nearer speech than extension of the fingers is to dextrous purposeful movements."

This is an example of pure physiology. When, however, this structure-functioning, productive of vocalization, which is present at birth, begins to take on a modified appearance the action can no longer be termed physiological. Here there is no hesitancy in designating the behavior as psychological. It cannot be classed as structure-functioning but must be designated as action due to the behavioral history of the individual.

Pure physiology may never be found in adult human beings. It is possible that all physiology at the human level has been influenced by behavior. Campbell (15) asserts:

[1] In this regard see Silvette and Britton (95): "It is pertinent to emphasize that the influences of emotion on important chemical constituents of the body are essentially similar to those which are brought about by severe muscular exertion. Both motion and emotion result in release to the blood stream and degradation in the tissues of energy-supplying substances, and concurrent accumulation of the products of tissue oxidation or metabolites."

Indeed, physiology as an independent science cannot exist at human levels because of the conditioning from birth by these symbolic and linguistic factors: and hence much of the reasoning by analogy from animal reaction to human behavior, current in contemporary medicine, must be falacious when it is not actually false to fact.

Although as viewed from the present approach Campbell restricts the effects of past behavior too severely (linguistic interaction is important but only one of a number of behaviors which are influential), the point is well made; the functioning of organs is certainly modified by past behavior.

The extent of this paper limits discussion to those studies presenting material which represents as nearly pure physiology as will be found in man during the waking state.[2] Investigation will be confined as nearly as possible to consideration of organ and system functioning. Nevertheless, where data cannot be dealt with in this manner the procedure will be flexible.

The disorganization of behavior and the seemingly integrated, often stereotyped disorganization which presents itself in stuttering can best be understood through observation of an individual's history. In this regard the writer wishes to adhere to a manner of dealing with the various behaviors termed *stuttering* which will not go beyond the observed events. To this end, beginning with the differentiation of feeling from emotional behavior, attention will be given the following phases of experimentation in the field of stuttering: respiration, cardiac rate, respiratory cardiac arrhythmia, vasomotor changes, tonus, reflexes, and eye movements. Analysis at the same time will be directed toward physiological reactions of normal speakers during startle. And, although this paper is not concerned with the development of stuttering, some probable channels will be indicated.

Historical Discussion

For obvious reasons only general historical trends can be indicated; much of the literature cited will be familiar and the remainder can be rather easily obtained.

Although there was much consideration of emotions before the time of Darwin, scientific interest followed his general period (**21**, 1858; **22**, 1872). This line of endeavor was followed up by Wundt (**126**), Goldstein (**36**), Strauss (**106**), and many others in Germany; by Lange (**61**) in Denmark; Pavlov (**79**), Bekhterev (**6**) (conditioning and reflexology respectively), and Luria (**65**) in Russia; Mosso (**71**) in Italy; Ribot (**82**), Dumas (**23**) and Pieron (**81**) in France; James (**49**), Cannon (**17**) and Kantor (**53**) in America.

[2]The present concern with physiology in no wise implies that the present writer considers stuttering to be of physiological origin. Changes in organismic functioning, viewed as an integral part of the behaviors known as stuttering, are developed during the psychological history of the individual.

Interest in the work of Darwin, aside from his theorizing concerning evolution, appears to have been focused on his rather accurate descriptions. Apparently he was one of the first to describe the behavior which later became known as *shock, choc, startle, surprise.* He termed it *start* and asserted "almost all the muscles of the body are involuntarily and momentarily thrown into strong action" (22, 285).

Wundt (126), following somewhat upon Darwin's lead, seems to have established, with his mental process composed of sensations and feelings, the precedent in the field of emotions which reverberates today in rather disguised form around the question of pleasant and unpleasant feelings.

James (49), Lange (61), and Sutherland (108) at nearly the same time published works purportedly indicating that the mental state characteristic of emotion followed a bodily change. It was termed the organic theory. Cannon (17) was somewhat opposed to this view and developed his emergency theory in which emotions were looked upon as release phenomena. It remained for Kantor (53, 54) to bring a semblance of order to the field of feelings and emotions.

Differentiation Between Feelings and Emotions

It had long been noted that peculiar, rather characteristic behavior resulted when an individual was confronted with a situation for which he had no immediate and organized response. The quotation from Darwin, above, is illustrative. The instantaneous reaction to a startling stimulus has greatly troubled psychologists from Darwin to the present. It could not be classed with the emotions, and yet it seemed to be intimately associated with affective behavior. Lange (61, 72) wrote, "It has never occurred to anyone to separate the emotion due to a suddenly discharged shot from the true affections." The same general position was taken by Ribot (82, 369): "It (the reaction to a startling stimulus) is a special emotional state which cannot be traced back to any other, consisting of a shock, a disadaptation."

Prior to the upsurge of interest and work on startle or surprise during the 1920's, Kantor made a sharp distinction between behaviors which he denoted by the terms *feelings* and *emotions.* The question of behavior which apparently had few antecedents was well settled: such reactions of an individual might be more or less intense, more or less characteristic, and were *biological,* replacing activities during the absence of any available, learned response. In other words, the replacement was chaotic and disorganized activity and was operative for just that instant during which the individual was thrown out of psychological contact with the situation.

This non-psychological activity, as well as feeling behavior, was developed in connection with stuttering in a previous pa-

per (44) which considered psychological differentials. It will thus be sufficient to point out here that feeling behavior is not chaotic, disorganized reaction upon a biological (S→R) level. No matter how severe the feeling behavior may be, short of "unconsciousness," it is learned behavior. In other words it is entirely due to the individual's past contact with objects and situations.

As described by Kantor, and employed in this paper, emotional behavior is exactly the opposite. It usually presents a replacement response, a biological contraction pattern, which, if modified at all, retains nevertheless its essentially reflex character.

Emotional Reactions (choc, startle, surprise, etc.)

Non-psychological behavior is not only a phenomenon found in natural surroundings where the stimulus is reacted to upon the basis of its natural properties (i.e., the adequate stimulus being a loud noise, loss of support, administration of cold water, electric shock, etc.). Nor yet is it only found in the above and in situations, where, for example, the individual is suddenly confronted with an angry bear or an onrushing train. It is also found, usually in somewhat milder form, in interpersonal or social situations. The criteria, however, do not change. If the individual is not equipped with behavior which is demanded by the situation while yet he is forced to attempt a conventional response, he faces social and psychological disruption.

Shock (93) partially recognized this point of view when he maintained that often "ideational" stimuli produce greater responses than startling auditory stimuli. Robinson (86) depicted the milder form which occurs constantly to everyone when he wrote: "To the subject such delays (blocks) are frequently marked simply by the failure of any response to take place." Although restricted to animals, the work of Liddell (62) is important and informative. He concluded:

> A neurosis can be induced in sheep and goats simply by requiring the animals to make sensory discriminations that become more and more difficult . . . to a point beyond their capacities.

Among others who have considered this phenomenon Goldstein (36) did a magnificent piece of work in describing ordered as opposed to catastrophic behavior; the latter is said to occur when the behavioral equipment of the individual is inadequate to the stimulational situation.

Emotional Behavior as a Contraction Pattern

The need for organic patterns corresponding to the various categories of "emotion" was recognized by James and endures even to the present day. That no one-to-one correlation exists between physiological conditions of organisms and reported

or observed feelings has been shown by Gaskill (33), Brunswick (14), Caster (19), Shock (94), Lacey (57), Landis and Gullette (58), and is summed up adequately in the following statement from Gaskill (34): "Our conclusion definitely is that emotional patterns are most highly variable; a plain indicator of emotion does not exist."

The fact appears obvious, then, that individual, historical factors are responsible for the variations in feeling behavior among persons. The particular behavior is the result of the history of the individual in connection with various situations and, therefore, could not be the same as the behavior of others except by accident or through identical culturalization.

When behaviors termed emotional by Kantor (54) are scrutinized, the possibility for patterning of performance is seen. The reason for maintaining this position is that during the instant of startle, surprise, etc. (it is usually of very short duration), the stimulus has acted as a biological stimulus in much the same manner as the applying of an electric shock, pressure, or stretch to an isolated muscle, or as when the patellar tendon reflex is elicited by tapping.

As would be suspected, the patterning in emotional activity is in general a contraction pattern; such would be expected following study of physiological reflexes. And the very writers who report no patterning during feeling responses concede that during startle, surprise, etc., a patterned response appears. In other words this is the only form of reaction, in feeling and emotional behavior, which is generally similar for all individuals. To mention a few investigators in this regard: Skaggs (97) found violent inspiratory contractions of the chest and diaphragmatic muscles; Gaskill (34) reported that "The pattern for abrupt surprise, then, as regards heart rate and blood pressure is distinctly different"; Strauss (106) asserted that startle is typified by flexion; Brunswick (14) reported sudden, spasmodic contractions; W. A. Hunt (46) found contraction patterning in infants; Landis and Hunt (60) devoted a small volume to the startle pattern. Evidence concerning startle as a contraction pattern is also found abundantly through examination of investigators' protocols: (Mosso, 71, 115; Berg and Beebe-Center, 7; Scripture, 89; Brunswick, 14).

Landis and Hunt (60) appear to have made the most complete study of startle. Cinematographic recording technique with exposures up to 3000 per second were used. The frames could thus be viewed at practically any speed desired. This was a highly advantageous method because the movements of the startle pattern are extremely rapid.

In working with the effects of startling stimuli on normal subjects these investigators found the following: an eye blink appeared first (and was always present if the startle appeared at all) with a mean latency of 40 sigma (0.040 second). Follow-

ing eye closure some subjects raised the lids immediately, while in others "a tonic perseveration appears, and the eyes remain tightly closed." A widening of the mouth, the second movement, had a mean latency of 62 sigma. A jerk of the head forward and flexion of the neck muscles appeared third in the series, having a mean latency of 88 sigma. If the response was of sufficient strength the shoulders were drawn forward, the upper arms abducted, the abdomen contracted, followed by a slight bending of the knees. A mild but complete response could be over in 0.3 second, while a complete, intense response might take 1.5 seconds. Absolute symmetry or asymmetry of movement may obtain ("One half of the body may show more elements of the pattern than the other half"), or relative asymmetry might be present.

The above orientative discussion gives very little consideration to the developmental modes of stuttering. As far as is possible, in keeping with data presented, this topic will be postponed. At this time interest is focused upon a natural reaction, common to all human beings, which might serve as the basic mechanism of stuttering.

The following experimental data on stuttering, while not entirely concerned with pure physiology, are perhaps as close to being in that category as can be obtained. Stuttering data will be compared with findings on normal speakers following startling stimuli. Although many point-to-point correspondences will be observed, exact duplication should not be expected. The reasons for the latter are, obviously, that the normal speaker has undergone no association of the response with speaking situations; that he is not often subjected to such conditions, while the stutterer is and so has ample opportunity to build surrounding, complex forms of behavior which in some measure compensate for his disorganization.

II. Respiration

That stutterers as a group have organic respiratory pathology—"most authorities insist that he is more or less advanced in pulmonary tuberculosis" (**109**, 166)—is given little credence at the present time. Unusual respiratory functioning, however, is generally characteristic of the stuttering block: "For some individuals the relationship between a given type of abnormality and the overt spasm is practically perfect" (**107**). Van Riper (**120**) found many consistent patterns during stuttering blocks. It is contended by these and other investigators that no one individual exhibits all the types of breathing disturbances, although he may evidence many more than one.[3]

[3]It should be remembered that much of the work in stuttering and startle has been accomplished with slow-speed apparatus which is often inappropriate for the rapid movements found in these phenomena. The pertinent records, those of the instant immediately following the stimulus

Sharp Inspiratory Gasp

Among the few reactions which may be characteristic of the repertoires of stutterers, adults at least, is the sharp, rapid, initial inspiration.[4] This does not always hold with the stutterer who has had training, but even in this case if the utterance of feared words is not approached on a word-to-word basis the gasp usually occurs on a block; it may be rudimentary, observed on records as a very minor inhalation, or it may take precedence and reverse the respiratory cycle.

The literature supporting this statement is extensive and can only be touched upon: Scripture (89) termed it a gasp and the evidence in his recordings is unmistakable; the protocols of Fagan (26) and Vera Travis (117) afford similar evidence. Fossler (31), Morley (68), Steer (103), Van Riper (121, 322) and Travis (111), although not particularly interested in the gasp as the initial movement in blocking, all bear witness to the prevalence of the interruption of expiration by rapid inspiration.

That a characteristic, quick inspiratory movement immediately follows a startling stimulus has been shown by Blatz (8), Berg and Beebe-Center (7), Brunswick (14), Cannon (17), Darwin (22, 285), Landis (59), Mosso (71, 218), Scott (88), Skaggs (98) and many others. This reaction was conditioned to a buzzer by Scott (88), and Walker (123) established it as a stable conditioned response in dogs.

Fixation of Respiratory Musculatures

Although the inspiratory gasp would not necessarily precede a fixation of the diaphragm, it evidently is the result of a rapid contraction of the inspiratory muscles. These may become fixed for various periods of time. A relation between the rigidity of various muscle groups in stutterers and affective conditions was recognized by Travis (110) when he asked, "What is responsible for the muscular fixation of the stutterer after an emotional shock?" Again in a later paper (112) he asserted, "Instead of muscular lability after an emotional shock there is muscular fixation." In regard to the same matter during stuttering Scripture (89, 10) wrote the following:

> The diaphragm, as seen by the X-rays, may suddenly be fixed or move downward in spasms. The spasms sometimes propel the abdominal wall outward in jerks. Often both abdominal muscles and diaphragm will become perfectly rigid and immovable.

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or beginning of the block, have often not been dealt with, could not be dealt with because of the slowness of the apparatus, or were disturbed by movements of the subject.

[4]The eye blink may be a second characteristic, while certain clonic and tonic contractions of the speech musculature may comprise a third. The latter may include spasmodic contractions of the diaphragm, and activity perseverations (prolongation and repetition of position) of laryngeal and oral musculatures.

Trumper (118, 17) through fluoroscopic means observed that the diaphragm during stuttering "appeared to me to quiver while remaining in a fixed position," and Bluemel (9) mentioned a "fluttering" of the diaphragm.

Steer (104) found in stuttering children (3-13 years) that lack of thoracic and abdominal movement was a prominent breathing irregularity. While using a designating term somewhat unfamiliar to speech pathologists, Stetson (105) describes the same characteristic: "In one form of stammering there is a clutch between the abdominal muscles and the diaphragm . . . " Morley (68) observed these reactions as tonic plateaus, while many others have summed such findings under abnormally long durations of respiratory movements: Vera Travis (117); Murray (74); Steer (103); Travis (112). In some instances (cf. Travis, 114, 107, 112) a prolonged holding of a movement has been ascribed to abnormally long inspiration, when, in effect, it is a tonic contraction, during which period the only movements of respiratory musculatures appear to be of a tremorous character.

In normal speakers following a strong stimulus, Brunswick (14) found the usual sudden, spasmodic expansion of the chest. The same activities were found by Skaggs (97) but he showed that they were accompanied by violent contraction of the diaphragm.

The dilemma of attempting to make interpretations from slow recordings is again apparent. Nevertheless, evidence from Brunswick and from cardiovascular studies to be discussed later indicate that in startle a rapid sequence of movements occurs in reflex manner. The first movement pertinent to this section is a spasmodic inhalation brought about by contraction of the chest inspiratory muscles. This decreases intrathoracic pressure, drawing the diaphragm upward. Following this action the diaphragm forcefully contracts and descends, remaining fixed in that position for varying periods of time.

Prolonged Inspiration and Expiration

The prolonged movements can usually be distinguished from the above fixations. In stutterers they are of various forms. Often but not invariably they are stereotyped (29, 31). They may consist of complete inspiration or complete expiration which is prolonged and upon which are superimposed small flutter-like movements (9). Short respiratory movements may appear during a long inspiration or expiration (117) and not after its completion, and prolonged respiratory movements are attested to by Travis (112), Steer (103) and many others. Speech with or without vocalization may be attempted at any phase, even during inspiration, according to Steer (104), Fletcher (20), Fossler (31) and Van Riper (112); and Van Riper (120) found respiratory movements during "rehearsal"

of a feared word similar to those occurring during the uttering of it.

The respiratory reactions of normal speakers to startling conditions include: slowing of movements (8, 59, 104); arrest of breathing movements (71, 98); Brunswick (14) showed that respiratory movements which occur following a shock are often rehearsed during anticipatory periods, and Faulkner (27) found that making disagreeable suggestions to his patients very markedly reduced their diaphragmatic action.

Vertical Incoordination

In stutterers the divergences from the supposedly normal parallel functioning of thorax and abdomen, and the side-to-side harmony (whether of thorax or abdomen) have been variously designated. Such anomalies have been termed asychrony, dyssynchrony, dyssynergia, dysintegration, antagonisms, oppositions, breakdown in the parallel relations, etc. Regardless of whatever aspect of the problem the various authors wished to emphasize with their particular terms it would appear that the phenomena in question show only three distinct characteristics. These are: (1) oppositions (records indicate that movements are in oppugnance); (2) differences in movement patterning (movement of the members[5] may show variation between them as to amplitude, duration, or number); (3) atemporal synchrony (movements are nearly identical, but those of one member are displaced, slightly preceding or following the movements of the other). The breathing aberrations which do not fall into the above forms are seen as combinative anomalies.

Among stutterers' breathing activities while attempting to talk, that of thoracic-abdominal opposition has received much attention. Fletcher (29) writes of point-to-point opposition, while Travis (112; 114, 169), Seth (90), Steer (103), Morley (68) and Henrikson (39) mention the same phenomenon as complete antagonism, breakdown in the more or less strict parallel phase relationship, or opposition between the abdomen and thorax.

Differences in patterning of abdomen and thorax, mentioned as the second type, have been found by Henrikson (39), Seth (90), Steer (104), Travis (114, 105) and many others. The differences reported are so numerous they cannot feasibly be mentioned.

Atemporal synchrony, although often recorded by investigators, does not always occur even during blocking. It is present in normal speakers at times (114, 104; 70). This form, termed asynchrony by Vera Travis, is also present in hori-

[5]Members here referred to are thorax and abdomen in vertical considerations, and right and left sides of either thorax or abdomen in horizontal relationships.

zontal recordings of normal speakers' breathing if, as she affirmed, her styli were in alignment (cf. **117**, Fig. 18).[6]

The above types of breathing anomalies have been found in normal speakers. Exaggeration of any one or all of these seems to be the general distinguishing feature between normal speakers and stutterers in this regard. According to Stetson (**105**):

> Dyssynchrony, when the chest and abdominal muscles move in opposite phase, is not a mark of a speech defect but occurs in any emphatic or forced utterance, and in staccato singing.

Steer (**103**) also found such oppositions in the normal-speaking children he examined. The findings of Seth (**90**) and Travis (**114**, 104) are not in accord with these results. They assert that in normal speakers there is "very close synchronization," and "very close correspondence between" abdominal and thoracic breathing.

Breathing under conditions of startle does not seem to have been recorded in a manner that would make comparison with the above data possible. Apparently the only instance of consideration given bilateral structures was that in which Landis and Hunt (**60**, 29 ff.) at times found opposition and relative asymmetry of hand and arm movements.

Horizontal Incoordination

Vera Travis (**117**), while not using the present writer's categories, found the above types of breathing movements in her stutterers while investigating horizontal dysintegration at the umbilical level during propositional speech. Her normal subjects are reported as evidencing none of the above-mentioned incoordinations between the right and left sides.

The present writer is familiar with only one additional study pertinent to this particular problem. Katherine Viau Mosier's (**70**) investigation, using normal and stuttering subjects pronouncing difficult words which were presented on flash cards, gave a comparison of horizontal speech-structure functioning at both thoracic and abdominal level. Thus, in this study, the normal speakers as well as the stutterers were under some stress.

Her pertinent results may be summarized as follows: Horizontal dysintegration (forms 1, 2 and 3 above, although not used as categories in her study) occurred during both normal and interrupted speech of stutterers and during normal speakers' interrupted speech and occasionally while they were speaking normally. Although the stuttering group showed more diametric opposition than the normal, the latter did evidence this

[6] The very structure of the diaphragm is favorable to this type of functioning. Normally, at full inspiration, the right side averages 15 mm. higher than the left (Bard, 4, 539).

type of breathing. Dysintegration occurred twice as frequently for the stuttering group and three times as frequently for the normal speakers, during interruption as during normal speech.

Irregularity of Consecutive Respiratory Cycles

Variabilities aside from those mentioned above are so very numerous that satisfactory classification is almost impossible. As the writer has pointed out, strict patterning cannot be expected in behaviors which are not purely physiological. And, as the reportings on stuttering cover such wide range, we must be content for the present to eliminate consideration of I-fractions, I/E ratios, etc., and reduce discussion of much literature to mere mention.

Generally, stutterers present greater variability of respiratory movements than do normal speakers. Steer (**103**) reported normal breathing movements in child stutterers during silence, and incoordinations, similar to those recorded by others on adult stutterers, during speech disturbance. Greater variability in stutterers' than in normal speakers' breathing movements during silence was recorded by Fossler (**31**), during silent reading and reasoning by Murray (**74**), during non-stuttered speech by Morley (**68**), during mechanical interruption of a well-learned, non-vocal movement sequence by Hill (**42**), and during stuttering by Morley, Strother (**107**), Fossler, Seth (**90**), Steer, Vera Travis (**117**), and many others.

Respiratory variabilities in normal speakers following shock have been indicated by investigators referred to in the preceding section. Other material which shows similarity to stuttering will be found in Berg and Beebe-Center (**7**), Lacey (**57**) and Caster (**19**).

Shallow Breathing

Although in a paper of this nature it would be preferable to limit discussion to actions during the instant of blocking and the period immediately following it, the character of the data appears to preclude such a rigid focusing of attention. The writer has attempted to isolate much of the material of this instantaneous and rather discrete nature. The literature, however, often deals with respiratory activities which are not present at the moment of blocking, but which are asserted to be somewhat characteristic of a particular stutterer or of stutterers as a group.

Gordy (**37**) was among the first American investigators to find a relation between shallow breathing and stuttering, while one-third of the stutterers examined by Trumper (**118**) were reported as shallow breathers. Starr (**102**) maintained that 80 per cent of his stuttering groups were sub-breathers, and Van Riper (**121, 322**) mentions this phenomenon as a deviation from normal breathing.

During the last several years shallow breathing has not been dealt with as such, but rather as changes in amplitude. Thus such studies as those of Murray (74), Morley (68), etc., treat this reaction somewhat more scientifically under the rubric of "variability" of amplitude and rate.

Exploration of the above problem in studies which make no mention of speech difficulty are here considered to be findings on a random sampling of normal speakers. Among the experimental work Landis (59) reported shallow breathing following shock; Skaggs' (97) findings are similar to those of Landis except that after a checking of rate and amplitude the inspiratory movements increased above normal; similar reactions with retardation remaining for three or more minutes were recorded by Blatz (8), and Alexander and Saul (1) found shallow breathing in their psychotics.

Wever (125), using cats, demonstrated a "flutter" effect that was conditionable. A similar reaction in response to shock was conditioned in dogs by Walker (123), and was shown to occur in human subjects by Hill (42). In the latter study the respiratory movements involved in the "flutter" were about one-half normal amplitude, about one-third normal duration and were extremely regular.

That shallow breathing is prevalent in neurotics has been mentioned before (4, 684). It has received further investigative attention by Alexander and Saul (1) and Mudd (73), among others. That the literature on the neuroses should not be cast aside as useless in connection with stuttering is indicated by Trumper (118, 41 ff.) who maintained that, as would be expected, shallow and irregular breathing tends to disappear as speech difficulties are lessened.

III. Cardiovascular Changes

Variability in cardiac functioning may have so very many antecedents that analysis becomes a problem in physiological calculus. Vasomotor and cardiac structures operate in very close conjunction. Blood pressure (B.P.), although dependent upon the amount and distribution of vaso-constriction, vaso-dilatation and cardiac output, is also partially a product of the relation of blood volume to arterial and venous system capacity, the viscosity of the blood and the elasticity of the vessel walls. Relatively speaking, however, the latter is a constant and need not be considered in more or less rapid changes.

Factors which control these various shifts, compensations, accelerations, etc., in meeting the physiological demands put upon the organism, are usually considered to be physical, chemical or reflexive. Balances between osmotic and filtration pressures are physical factors. An example of chemical factors is afforded by the study of Cannon and Britton (16): cats'

hearts were denervated in the otherwise intact animal; when the adrenal glands were not eliminated the pulse rate increased an average of 22 beats per minute after the animals were exposed to dogs, while, after being placed in similar situations following adrenalectomy, pulse rate increased an average of two beats per minute. For an example of reflexive control the carotid sinus and carotid bodies may be mentioned. The former is affected by pressure and the latter by the chemical composition of the blood, and both reflexly affect heart rate.

When it is considered that in addition to the above factors and many that have not been mentioned, heart rate and amplitude are responsive, both physically and reflexively, to respiratory movements as well as to situational contexts, the complexity of analysis clearly reaches formidable proportions.

A few of the chemical influences have been discussed here and in a former paper (43). Several physical factors will be touched upon when considering sinus arrhythmia and the Valsalva effect, and reflexive influences will be partially discussed under volume changes.

Heart Rate

Fletcher (29) indicated that his stutterers' pulse rates averaged 88.9 before reading, 99.1 at the beginning and 97.2 at the end of the oral period. Higher rates for stutterers than for their controls, and increased stroke amplitude during fear of stuttering, were reported by Robbins (84). Travis, Tuttle and Cowan (115) found higher mean heart rates in stutterers than in their normal speakers: during silence, stutterers 86, normals 77; during speaking, stutterers 110, normal speakers 88. In their investigation of cardiac rhythm during silence in routine examinations, Palmer and Gillette (76) also found higher rates in stutterers. The average for all normals was 74 as against 80 for the stutterers. The stuttering female children averaged four beats slower than the stuttering male children as against a difference of ten beats between normal speaking children. Female stutterers had significantly lower rates than male stutterers while a reverse sex difference held for normal speakers. The female stutterers had more regular heart rates than all controls, while the male stutterers showed significantly greater irregularity than their controls.

Ritzman (83) found no significant differences between stutterers and non-stutterers, studied under basal conditions, in heart rate recorded by palpation and cardiographic methods. He states, however, that the stutterers designated as severe showed lower pulse rates in one section of his data. (Three sets of data were gathered during basal conditions, and one set during afternoons. All measures were "obtained during silence and conditions of rest.")

Problems are encountered in comparing the heart rates of stutterers, during stuttering, with those of normal speakers during acute surprise, or momentary, seemingly no-solution situations. Electrocardiographic work might be the answer, but to this writer's knowledge no recordings have been made at the instant a severe block was begun. Extra systoles followed by some irregularity would be the expected reaction. Travis, Tuttle, and Cowan (115) recorded extra systoles during severe stuttering but did not indicate the precise moment of their occurrence, while Ritzman (83), if he found any extra or premature contractions, made no mention of them.

Effects of startling stimuli often take the form of extra systoles; the protocols of Mosso (71, 115) and Berg and Beebe-Center (7) afford graphic evidence. The latter present excellent material which not only shows the immediate effect of a startling stimulus, but succeeding cardiac action as well. The effects are indicated as a momentary contraction pattern followed by irregularities. They term these a "replacement reaction."

Landis (59) reported increased rate and irregularity following sudden stimuli, while Berg and Beebe-Center showed that in their subjects the highest peak rate occurred at about 3.2 seconds following the stimulus and that irregularities continued for some time.

Since it is rather well established that during non-basal conditions, especially during speech, stutterers as a group present faster and more irregular pulse rates, the report of Lacey (57) is of interest for the physiology of stuttering. He wrote: "cardiac acceleration in states of emotion is due mainly to muscular exertion." In this same connection Hathaway's (38, 232) work may have important implications. He conditioned heart rate increases during exercise to a buzzer and training made the response stable.

Blood Pressure

In a study only incidentally considering B. P., Robbins (85) reported 110/80 normal levels, 128/? during slight stuttering, 125/108 during reply to an unexpected question, and 118/? during physical work. Ritzman (83), following an investigation comparing normal speakers and stutterers as to B.P., concluded:

> No significant differences were found on diastolic, systolic, and pulse pressure measurements. The female stutterers showed a tendency toward higher pulse pressure than their controls.

Systolic pressure of female stutterers (83, Table XIII) is also indicated as being somewhat higher than that of their controls; it is even slightly higher than that for either the male experimental or control group. The small number of cases, however, would make conclusions tentative.

Difficulties encountered when dealing with cardiac rate are similar to those inherent in B.P. studies. It is seemingly impossible to discover any characteristic patterns in B.P. changes during affective behaviors except for that of startle or surprise (i.e., non-psychological behavior segments).

Upon unexpected stimulation Landis (59) found that "there is a sharp rise followed by an immediate fall" in B.P., while in a later study he reported the above and also many irregularities in pressure. Sudden "emotional" stimuli are maintained by Sherman (92) to cause the most pronounced changes, and Hathaway (38) reports a temporary rise followed by a marked decrease in pressure; the fall may be so great in fright as to occasion fainting.

We are led to believe, then, that short term B.P. changes during periods of stuttering are very frequently similar to those evidenced in startle. An assumption is at least partially made here. We have little direct evidence aside from the data of Travis, Tuttle and Cowan (115) that relatively rapid changes in B.P. (the Valsalva effect) occur during stuttering. Sharp, incisive respiratory aberrations and vasomotor alterations would appear to be very strong indirect evidence. Bard (4, 495) asserts:

> The ventricular pressures are developed relative to their own environment, the thorax, and as the pressure is lowered there, the pressures in the large vessels fall correspondingly (Hamilton *et al*, 156).

As it has already been shown that respiration during the beginning of a block, and often for longer periods, resembles that immediately following startle or shock, the B.P. changes might be considered as roughly similar.[7]

Sinus Arrhythmia

Sinus arrhythmia, although being generally considered as variations in cardiac rate during one respiratory cycle, also includes variations in pressure and flow. Rate is in part a function of pressure and, being more accessible, has been studied in greater detail.[8]

Ritzman (83) gave an excellent graphic presentation of this phenomenon as well as enumerating many of its deter-

[7]Consequent upon startle and often during the beginning of a severe block there is a spasmodic inhalation brought about by expansion of the chest and a rapid ascent of the diaphragm. This decreases intrathoracic pressure, draining blood for an instant into the visceral pool and decreasing B.P. The diaphragm then forcefully descends and may remain fixed in a contracted state and B.P. is raised.

[8]Cardiac rate may increase slightly as inspiration begins, tending to decrease as inspiration continues. It increases during expiration and increases more noticeably during the expiratory pause and the first part of inspiration. The "maximum may occur during the middle of inspiration, during late inspiration, or during expiration according to the respiratory rate" (Bard, 4, 498).

miners. The causal factors as asserted by Bard (4, 500) are very complex, but in general are given as three in number: (1) "an effect of the respiratory center on the tonic vagal center which regulates the heart rate," (2) reflex cardiac effects produced by action of pressure receptors in the lungs and mediated by the vagus, and (3) changes in venous return acting through Bainbridge and MacDowell reflexes.

Travis, Tuttle, and Cowan (115) found some small differences between their stutterers and non-stutterers in heart rate changes. During silence the mean highest rate on inspiration differed from the mean lowest rate on expiration by 6 for the stutterers and by 7 for the normal speakers. Speaking increased the minute-rates slightly more in the affected group and changed the differences between respiratory phases; the difference between the mean highest rate and the mean lowest rate during speech was found to be 11 for the stutterers and 10 for the normal speakers.

Several differences during silent non-basal conditions are reported by Palmer and Gillett (76):

> All stutterers have less regular pulse rates than all normals. In general the responsibility for this deviation is found entirely in the *male* sex (76, 10). Peculiarly, the males in inspiration show no differences from their normal controls . . . but significantly more heart beats decrease in length during expiration.

The females when compared with their controls exhibited "more decrease in rate, length of heart beat, and less tendency towards cardiac respiratory arrhythmia than their controls."

Although in this study measures were supposedly taken when neither group was speaking, "it is seen that no differences exist between the sexes when they are stuttering" (77, 136). The conclusion is also reached on the same page that "The responsibility for respiratory cardiac arrhythmia is found to be largely in the female [*sic*] sex."

Ritzman (83), using the individual subject as a statistical sampling unit (Travis, *et al* adhered to this technique while Palmer and Gillett used the single heart beat and respiratory phase) "during silence under conditions of rest," found no "significant differences between stutterers and non-stutterers." However, "the female stutterers tended to have less sinus arrhythmia than their controls."

If sinus arrhythmia is, as Palmer and Gillett (77) state, "an essential reflex phenomenon controlled by the state of the somatic circulation," their hypothesis, "Stuttering is the result of a sex-linked neuro-physiologico-metabolic etiology," would not seem to be too valid. In the first place they concede that emotional factors influence sinus arrhythmia, and, as will be shown shortly, circulation is greatly influenced by affective conditions. When, in addition, it is considered that respiratory movements do exert some influences on heart rate, the breath-

ing of stutterers during speech, and the affective situations attendant upon speech, would undoubtedly have reverberations in cardiac functioning. There is also little doubt, judging partially from the statements of Campbell (15), that such physiological reactions are conditionable. Experimental evidence for this contention is afforded by Minut-Soroktina *et al* (67), who conditioned sinus arrhythmia to indifferent stimuli.

Evidence points very strongly toward a contextual, historical explanation of any differences which exist between the sexes in sinus arrhythmia. Other divergences may also be explainable on a similar base. It has been shown that a trend exists for the female stutterer to approximate the male stutterer in regard to metabolism, blood pressure, heart rate and sinus arrhythmia.[9] It would appear then that, aside from the influences of the oestrus cycle, male and female are not so different physiologically if subjected to similar circumstances.[10]

The Valsalva Effect

One of the reactions which may affect sinus arrhythmia, regularity of cardiac action and B.P. is the Valsalva reflex. In this phenomenon intrathoracic pressure is increased through forced expiration with glottis closed. Following an initial rise in aortic B.P. a decline appears in about three seconds. The decline is in direct proportion to the increase of intrathoracic pressure and may reach a low level. Figure 2, Travis, Tuttle and Cowan (115), illustrates the decrease in heart rate during this effect; the measures were taken during tonic stuttering.

Due to the MacDowell reflex a fall in venous pressure reflexly causes vasoconstriction. And Lieb, Mullins and Taylor (63) indicate that a deep inspiration is followed by vasoconstriction. The significance of vasomotor changes will be discussed in the following section; however, it may be noted here that B.P. and cardiac action may be extremely affected by respiratory aberrations (cf. Fenning, 28). It may then be concluded that in regard to severe stutterers, or those that do considerable "forcing" during speech, the Valsalva reflex and concomitant physiological changes are of more than passing interest.

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[9]Cf., e.g., the tables and conclusions of Palmer and Gillett (77), and Ritzman (83). In Ritzman's study Table I illustrates the heart rate tendency very well and Table IV to a slight degree.

[10]During this war period investigations might be undertaken to determine just how closely the sexes do approximate each other in the above-mentioned functionings when subjected to similar strenuous conditions. The findings on severe stutterers in these connections should be compared with the description of fatigue and exhaustion of normal speakers following continued shocks: "The path of the upset was marked by a falling pulse pressure, shallower respiration, and a falling metabolic rate" (Landis, 26).

Vasomotor Changes

It is posited by physiologists in general that the two divisions of the autonomic nervous system (A.N.S.) are antagonistic in function.[11] The sympathetic N.S. is inhibitory (and vasoconstrictive) to the entire gastrointestinal tract (with the exception of the sphincters), to the pupil of the eye, and to tissues in general including the brain. It is excitatory (and vasodilatative) to the heart, including the coronary circulation. Parasympathetic innervation is excitatory (and vasodilatative) in character to stomach, small intestines, sphincters, pupil of the eye and the brain, and is inhibitory to cardiac action. Bard (4, 439) indicates that there is no evidence of vagus dilatators in the abdominal viscera, and Schneider (87, 211) reports that

> The vasoconstrictor nerve fibers are most abundant in the arteries of the skin and abdominal viscera, while the vasodilatator fibers are most abundant in the glands and muscles.

As would be suspected in view of the relatively long latent periods of smooth muscles, vasoconstrictor response continues for some time following the cessation of a stimulus and fades out slowly.

Adjustments between blood volume and the vascular bed are mutual as a rule unless pathological conditions exist. Chemical mediators such as adrenalin, acetycholine and histamine may be very influential in producing vasomotor changes, yet the changes they produce are reflexive in character and mainly involve the veins, venules and capillaries, and in extreme cases the arterioles, arteries and blood reservoirs (4, 517). If B.P. is to be maintained, vasodilatation in one area must be compensated for by vasoconstriction in some other area, or by increased cardiac minute-output. The blood vessels of active muscles are either dilated before contractions begin or become enlarged very shortly thereafter. If the combined effects of vasoconstriction in other areas and increased heart action do not compensate for the increased vascular bed, B.P. falls.

Plethysmographic studies on stutterers have been neither numerous nor extensive. Fletcher (29) found that the volume of blood in the hand dropped when subjects were asked to read. This drop was followed by an irregular rise which lasted to the end of the reading period. The amount of rise and the irregularity of its course were correlated with severity of stuttering. A plethysmographic study of Robbins (84) on shock and stuttering yielded further evidence that vasoconstriction occurs in the extremities during stuttering. His findings may be summarized as follows: Fear of stuttering with no attempt at speech produced vasoconstriction, although not as

[11] In view of the factors that are known concerning intact organismic activity, a "balanced functioning" might be held as a more defensible position.

much as stuttering did. Subjects who showed considerable fear of stuttering had greater vasoconstriction and slower recovery in relation to stuttering than they had during and following shock. On the average, they showed 80 per cent more vasoconstriction to shock, attained this condition more rapidly, and took 23 per cent longer to recover than did normal speakers.

In a follow-up study on a trephined stutterer, using a loud noise as a shock stimulus, Robbins (85) reported similar findings and further asserted: "Pronounced shock, fear of stammering, and emotions of every kind always brought about increase in brain volume . . ." During free speech or reading brain volume returned to near normal; highest intracranial pressure was recorded during severe stuttering.

Normal speakers' vasomotor reactions to startling stimuli were studied by Robbins (84) as has been stated. They were very similar to the reactions of his stuttering subjects while having speech difficulty. Mosso (71, 94) found a decrease in hand and forearm volume even upon slight "emotion." Anticipation and excitement, or tension, are held by Lund (64) to reduce the volume of skin, extremities and splanchnic regions and increase the volume of heart, brain, lungs and large skeletal muscles. Cannon (17, 93) is also of the opinion that "emotion" and strong exertion alter the distribution of blood, shunting it from the abdomen into the heart, lungs and skeletal musculatures.

Vasoconstriction in the extremities, aside from being brought about by respiration and reduced venous return, might be due to sympathicotonia. Although brain volume increases indicate parasympathetic activity, if the two occur together it would argue for no fixed relation between the two parts of the A.N.S., but rather a balanced functioning according to the situation. Nevertheless, in addition to vasomotor changes evidence has been gathered which points toward stutterers in general having considerable so-called sympathetic dominance.

In this connection Sovak (100) found that stuttering was worse after administration of adrenalin and improved after pilocarpin. (As is well known the former potentiates sympathetic action and the latter parasympathetic.) However, the picture becomes somewhat complex when it is considered that adrenalin in weak dosage causes vasodilatation but vasoconstriction when the concentration is strong (Bard 4, 443). Cantril and Hunt (18) showed that injection of adrenalin usually produced an organic state typical of emotion but seldom a "true emotion." When the latter was produced it was conceded that it came about through the individual's having been aware of similar physiological states during past unpleasant situations. In addition to these conditions, rates of responding are increased immediately after injection of adrenalin but this

rise is soon followed by a sharp decline decreasing the net rate of response by 30 per cent (40).

If, as is reasonable to suspect, adrenalin output is increased during stuttering, at least part of the minor tremors in legs, hands and speech musculatures, as well as some of the tensions in visceral and thoracic regions, may be traced to this source. Reported slowness or prolongation of stutterer's movements may also be partially based upon the after-effects of adrenalin secretion.

In view of the fact that heart rate, blood pressure, vasomotor changes and the various respiratory reactions in stuttering are similar to those of normal speakers in startle situations, we are forced to conclude that stuttering develops from, or at least involves, a universal physiological response pattern. This pattern is reflexive in character and with the exception that it is organismic, or relatively generalized, it is similar to the patellar or any other physiological reflex. It is characteristically produced by startle, surprise or other catastrophic situations,[12] including social circumstances for which the individual has no adequate or immediately available response. Although this reaction is too rapid to be affected by its own adrenalin secretion, behaviors which follow it may thus be influenced, or if, as in stuttering, these catastrophic situations occur frequently the emotional pattern (blocking) may be aggravated by adrenalin-produced tremors and tensions.

IV. Tonus and Tetanus[13]

Muscular rigidities and tensions have received extensive attention in the literature of stuttering, yet consideration has been more expository than experimental. Investigations undertaken have mainly dealt with peripheral structures and, to this writer's knowledge, no studies have been concerned with visceral activities during stuttering. Although Travis, Tuttle and Cowan (115) found muscle action currents showing in their electrocardiograms taken while subjects were stuttering, interpretation was made in terms of general and not visceral muscular tension.

Shackson (91) provided some slight evidence that mild, latent chronic tetany is characteristic of stutterers as a group. Some support might be gained for this contention if it were conclusively shown, as has been reported, that stutterers in

[12]The term *catastrophic* is used here to indicate a situation which breaks the orderliness of events, i.e., a situation in which the behavioral equipment of the individual, at the particular moment, is inadequate to the stimulating conditions.

[13]*Tonus* as used in this paper denotes a state of partial contraction, whether of skeletal or of smooth muscle, while *tetanus* refers to a more intense state of continued contraction with the absence of twitching.

general are slower in manual actions,[14] while other indirect approaches would probably yield even less pertinent material. Metabolic studies, for instance, often afford ambiguous results, for tonus of smooth muscles apparently can be maintained with little increase in oxygen consumption (25, 116), and the mechanisms operative do not appear to be fundamentally different from those of tonus or tetanus of skeletal muscle.

Brown and Shulman (13), within the limits of their study, showed that stutterers have lower intramuscular pressure in the forearm than normal speakers, the female stutterers gave the lowest pressure reading; differences, however, were not reliable. These measurements are in accord with the above findings that forearm volume decreases (vasoconstriction) in stuttering, with possible indication of some relaxation in this area. Nevertheless, this gives no consideration to visceral or larger skeletal musculatures, and the assumption should not be made that similar conditions, even during silence, exist throughout the organism.

Travis and Fagan (113) measured the resistance of the pendant hand to 40-ounce blows. In the normal speaking group tension or resistance rose from a low point during silence to a high peak during speech followed by a decrease to the initial pre-speech level when silence again occurred. The stuttering group showed more resistance during initial silence (i.e., they remained at a higher level than the normal speakers), while during stuttering a marked increase was noted which, however, was somewhat below the tension exhibited by normals during speech. During the free speech of stutterers resistance dropped nearly to the silence-level of the normal group, but, upon stopping speech, resistance rose slightly to approximate the pre-speech level.

Reflex times (achilles and patellar) corroborate the belief that stutterers are often in a state of raised tonus or even tetanus. After-discharge or some sustaining of contraction may be signified by certain qualitative differences in tendon reflexes discovered by Travis and Fagan (113). They wrote: "It consists of a clonic movement of diminishing range which

[14] At first glance the following reports in this connection appear paradoxical: Jasper (50), lower chronaxie in stutterers; Shackson (91), mild latent tetany; Travis (114), shorter reflex times and greater amplitude of reflexes; Hill (42), greater difficulty of stutterers in learning a movement series, and greater number of prolonged movements; Eisenson and Pastel (24), greater difficulty of shifting from one task to another; West *et al* (124, 56), lower rates of diadochocinesis of stutterers than of normal speakers. At second glance these findings articulate rather well: the shorter chronaxie and latency may afford faster, sudden contractions. This as well as the greater amplitude of reflexes might be the result of raised tonus, while the difficulty of learning a movement series, the prolonged movements, the difficulty of shifting tasks and the lower diadochocinesis might be similarly brought about by the increased tonus.

follows the initial reflex contraction and which is more striking in the record of the stutterer."

Closely allied findings are reported by Jacobson (47): "Clinical evidence of nervous hypertension is seen in the form of increased reaction or reflex hypertension," and he continued, "among the evidence of nervous hypertension are (1) increase of tendon reflexes . . ."[15] This type of reporting together with findings that reflexes will increase in amplitude and decrease in latency if certain relationships obtain between increased muscular tension and the application of the stimulus, give a rather sound foundation for inferring that the stutterer in general is muscularly hypertensive (observation of stutterers together with subjective reports alone should be nearly sufficient evidence on this score).

The decrease in resistance of the pendant hand and the decrease in amplitude of the patellar tendon reflex during the stutterer's free speech (these reflexes will be taken up in the next section) afford further proof that the stutterer is operating under a generalized tension. In support of this contention Mowrer's work (71) may be cited. He found that muscular tension is built up in anticipatory periods before shock and is very low immediately after application of the stimulus. In a somewhat analogous situation Van Riper and Hill (122) found that an individual could utter a word with comparative ease immediately after stuttering on it. From these experimental data, in view of the fact that Travis and Fagan (113) obtained their free-speech samples as best they could *between* stutterings, we may conclude that tension in general is decreased following blocks, and also that such decreased tension does not in general characterize the stutterer.

The investigations of Miller (66), Jacobson (48) and others show that response to a surprising or startling stimulus is enhanced if the subject is already responding to that or some other situation (i.e., if the individual is already under some heightened degree of muscular tension). With the stutterer, if the whole organism, and especially the speech musculature, is under tension and possibly exhibiting unusual tremors, attempts to talk would result in exaggerated, incoordinated, or summated movements even if the startle pattern were not elicited.[16]

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[15]These statements do not imply that stuttering is entirely a neurosis; the foregoing discussion of emotional or startle reactions should partially make the distinction.

[16]Work in voice, such as that of Travis' phonophotographic study (111), points toward increased tonus of stutterers during speech, and while sustaining a tone following shot and shock stimuli.

V. Reflexes

Oculocardiac and Solar Plexus Reflexes

Many European workers in stuttering markedly emphasize the assumed operation of the vegetative nervous system. Two reflexes have been given special attention in this connection: the oculocardiac reflex (heart rate is lowered by pressing the eyeball) which supposedly indicates vagotonia, and the solar plexus reflex (weakening of the pulse through pressing the solar plexus) which is taken as a manifestation of sympathicotonia.

Sovak (**100**) found these reflexes normal in 23 per cent of his stuttering subjects. The others showed positive solar and normal oculocardiac reflexes.[17] Hogewing (**45**) cites Seeman as finding extreme irritability of the sympathetic N.S. in 80 per cent of his stutterers, but gives no data. And Helene Kopp (**55**) asserted that she found the significance of motor disturbances so great that she considered stuttering "first and above all a neurologic disorder . . ."

Patellar and Achilles Reflexes

Travis and Fagan (**113**) report that achilles and patellar tendon jerks of stutterers during free speech are depressed, while during stuttering they are increased. In normal speakers these reflexes are increased during speech. Stutterers, especially during tonic stuttering, exhibit significantly reduced reflex time, while in normals there is a slight tendency for reflex time to become longer during speech.

The data summarized above show the probability that reflex actions are not only functions of the stimulus intensity, but are also functions of the tension condition of the particular muscles (not of hypothesized states of the nervous system). In addition we present the following from Courts (**20**):

> A comparison of means based on two sets of five responses for each of 60 subjects suggests that the amplitude of the knee-jerk offers a consistent index of changes in muscular tension.

It may further be added that Tuttle (**119**) found the height of the knee-jerk to be 9.91 times greater during active problem solving than during a passive condition.

In view of the fact that no one knows a great deal about the operation of the nervous system and certainly less concerning its functioning in the intact organism, the following statement from Helene Kopp is of interest:

> As may be seen from the tables, neurologic examination alone did not detect any neuropathologic signs, in spite of the fact that all our patients exhibited motor deficiencies . . .

Kopp and many others find themselves entangled in a dilemma which, apparently, cannot be resolved through exam-

[17] Cf. Sovak, also, for his use of adrenalin and pilocarpin.

ination of the N.S.[18] Proof of this contention, and also indication of the probable answers, has been afforded by recording of the disappearance of neurotic signs following the solution of difficult problems. And even more dramatic evidence has been the production of motor disturbances during the establishment of experimental neuroses (**56, 3**).

VI. Eye-Movements and Pupillary Changes

Eye-Movements

Various forms of nystagmus not characteristic of normal speakers have been recorded by Jasper and Murray (**57**) as occurring in stutterers. They also found eye-movement disturbances which consisted of automatic reflexes, binocular incoordination, and rigid fixation of one eye while the other showed vertical twitches during speech difficulty. Murray (**74**) reported a decrease or loss of normal ability to fixate during the silent reading of stutterers. Travis, Tuttle, and Cowan (**115**) mention a relative inability of the eyes to fixate continuously together with changes in pupillary reflexes during stuttering. They maintain that actions such as blinking and grimacing are exhibited while the stutterer is attempting to break a block.

Stuttering during propositional speech yielded a variety of lateral eye-movements in Moser's study (**69**). Tremors were observed to increase in head and eyes, and periods of rigid fixation as well as periods of general chaotic disturbance were reported.

Pupillary Changes

In an extensive investigation of the pupillary reflex by photographic means, Gardner (**32**) found that

> . . . one hundred per cent of stutterers showed increases in dilated diameters during stuttering, while 54 per cent of normal speakers showed identical diameters and 23 per cent showed decreases during speech.[19]

Pupillary light adaptation, following ten minutes of dark adaptation, was altered more by the extra-stimuli of shot, bell, electric shock, etc., than by stuttering. In general the trends were in the same direction, i.e., a lesser and slower constriction.

VII. Replacement Activities

Judging from much of the data already given it would be suspected that any behavior which was in progress before stuttering or startle occurred would, upon their appearance,

[18]Kantor (**54**, Vol. 2, 22) writes, "If anything can be clearly discovered from the observation and description of emotional behavior it is this: that such behavior occurs only under definite external conditions and can therefore be described only in terms of such conditions."

[19]Stuttering was not continuous and sometimes occurred prior to photographing.

be suddenly broken off. This assumption is inherent in the psychological position which is being partially presented in this paper.

As indicated in the orientation, if an emotional behavior segment occurs there will be an instant during which all previous behavior is stopped. This may occur upon startle, sharp surprise, or upon an individual's being forced into a situation for which he has no adequate, immediately available response.[20] During the instant when the individual is out of psychological contact with the situation, biological replacing activities take over. It is these replacing activities, initially the contraction startle pattern, which afford the means for the development of the sometimes orderly, sometimes disorderly disorganization found in the stuttering block.

Travis, Tuttle and Cowan (115) mention that during stuttering there is "inability to continue voluntary movements of certain parts of the body." It will be remembered, in addition, that they investigated heart action and recorded extra systoles during stuttering. Berg and Beebe-Center (7) after finding a similar phenomenon during startle termed it a "replacement reaction." And the work of Landis and Hunt (60) showed that they found some interference of startle with voluntary action, but this point was not expanded.

Some of the strongest evidence in support of the present writer's position is given by Herren (41). With both hands his subjects rhythmically pressed bulbs which were connected to styli acting on kymographs. He concluded that speech of normal subjects had no effect upon voluntary movement, and that no differences were discernible between the performances of stutterers and normal speakers during silence. However, there were periods as long as 22 seconds during tonic stuttering in which no hand movements occurred. During tonic stuttering hand movements ceased abruptly, while during clonic stuttering there were skipped beats or decreases in the extent of hand movement. The absence or decrease in movement "corresponded roughly with the length and severity of the block." The same results occurred if only one hand was used, and it made no difference whether it was the right or left. When both hands were used some point-to-point oppositions were recorded. Results when feet and toes were involved were very similar to those obtained for the hands.

That all behavior would be broken off following the stimulus was one criterion of an emotional reaction.[21] The main

[20] At least part of the stutterer's lack of readily available, adequate response is due to his evaluation of the situation as catastrophic.

[21] In this paper the term *behavior* has been reserved for the designation of psychological responses, while *reaction* refers in general to physiological activities.

contention of this paper revolves around the fact that during the instant of startle, surprise or disruptive fear all behavior-in-progress ceases. In regard to stuttering in this connection, no more adequate evidence is necessary than that afforded by Herren. It is so obvious that it has been overlooked. In their more relaxed moments certain authorities have pointed out that during a severe block the stutterer is "out on his feet." Johnson and Solomon (52) present evidence which indicates that "expectation . . . need not operate on a highly conscious level," thus indirectly signifying the automaticity of stuttering. Still other workers have mentioned the compulsive attentional features of severe blocking. Yet the significance of the eye blink, the vacant stare and the compulsive jerkings has been unheeded.

The chaos that occurs during the period when psychological contact with the situation is broken off is probably appreciated by but few people who do not stutter. Stuttering in this regard often becomes an unpleasant adventure in which the individual figuratively, and sometimes literally, closes his eyes and jumps into the dark. The response that is demanded by the situation is just not there. It would not be so disconcerting if the orderly responses of speech merely stopped. The individual might reorient himself. But the difficulty of the stutterer is chiefly brought about by the disorganized contraction patterns, and other biological reactions, which replace the orderly progressions of speech.

VIII. Shock and Stuttering

Delineation of the onset and course of stuttering has very frequently led authorities to the conclusion that some form of shock instigates speech blocking. The ordinary vicissitudes of life that might have no effect during health might strain a child's behavior equipment during or following disease. Or, although the individual may have good health, his home situation, etc., may be of such a constantly exciting character that the child, always being in a "jittery" condition, is extremely vulnerable to shocking stimuli. Or again, the average rather calm child may also be subjected to disrupting circumstances. That all children are thus exposed is obvious, but to assume that they are equally exposed is erroneous.

In addition to this, when the fact that children differ in linguistic ability[22] is considered, it can be seen that the degree of speech disruption would not only depend upon the severity of the situation, but also upon the integration and strength of the child's linguistic behaviors.

At one time or another probably everyone who has dealt with stuttering has considered it as a shock phenomenon.

[22] No native capacities are referred to by use of the term *ability*.

Anderson (2) recognized the chaos during stuttering; Brown (12) wrote of stuttering as "a response to an emotionally conditioned stimulus," and Solomon (99) mentioned a "pattern of defense adjustments" in the stutterer's behavior as reactions to emotional situations. Ssikorski (101) believed that shock initiated most cases of stuttering, and Robbins (85) through his studies of shock and stuttering recognized similar connections. (That stuttering might develop following the presentation of sudden stimuli was observed by Bekhterev (5, 378).) Travis (110, 111), in his early writings, appeared to favor emotional factors as very influential in stuttering, and the work of Simon (96), although emphasizing the emotional aspect, stresses breakdown in behavior because of too great complexity of the situation. The lack of adequate response during stuttering was designated as being due to inhibition of the conditioned response of speech by Bluemel (10).[23] He also cites very pertinent material in regard to shock and stuttering. The theoretical postion of Mabel F. Gifford (35) is primarily based upon the influence of shock on the individual, while Fletcher (30) unhesitatingly places responsibility for stuttering, not in the person, but in the situation.

Trumper (118, 12) depicts one of the emotional conditions concerned with speech interruption in the following way: "The child attempts to describe something that has deeply impressed him. He gasps and gesticulates but says nothing." This, perhaps, is descriptive of one type of situation that may be a forerunner of stuttering. Here the speeh equipment of the individual is inadequate to the momentary situation. One such situation in some cases, or several severely disrupted situations in other cases, might be sufficient to associate a milder form of these reactions with that particular speaking situation or speaking situations in general. Or, what is more probable, if an individual has been subjected to shocking conditions, particular words or objects in that situation gain specific stimulus values. Following this when these words or objects are again encountered some disruption of behavior could be expected. In children, where anticipation, awareness and struggling do not intensify the blocking, the carry-over effect of the precipitating circumstances usually takes the form of easy repetitions or prolongations (biological replacing activities) until the response occurs.

At least two other conditions are seen as contributing to a similar behavioral disruption (i.e., as antecedent to breakdown

[23] *Inhibition* is employed by Bluemel in a very loose manner, and seemingly refers to some force within the individual which stops behavior. If inhibition were designated as being situational influences it might be acceptable, but the primary assumption that language is a conditioned response does very little justice to the evident complexity of the events.

reactions where integrated responses fail and are replaced by biological reflexes and perseverations). One would be that situation in which the child's linguistic equipment was not adequate to stimulating conditions even when pressure factors were absent. Another form of disruption would be that encountered when two stimulus objects were reacted to at the same time. In other words an individual might have feeling responses to a situation, consisting of various tensions, while he attempted to talk. Interference would occur which would result in a breaking-up of the speech responses. Or again, there may be interference between linguistic responses. In all these forms essentially similar activities are evident: integrated, orderly behavior breaks down and is either mildly or extensively replaced by fundamental reactions. Replacing biological activities occur which become associated with speech and speaking situations. As the person becomes aware of these hindrances, together with concomitant social stigma, further difficulties arise. From this point onward the course of speech depends upon the strength of stimulating conditions (this would include the individual's evaluation of his difficulty), the strength of the linguistic behaviors of the individual, and the strength of the associations between speech and the disruptive actions.

If the data reviewed in this paper are reliable, and if the interpretations are legitimately derived, stuttering offers a very similar picture to that of startle or shock. The similarities mainly depend upon the intensity of the two reactions. If tonic stuttering blocks are of sufficient intensity nothing occurs but what will be found in a severe surprise or startle pattern: chest muscles, diaphragm, neck and jaw muscles are rigidly fixed; the eyes are dilated and are either firmly fixated or exhibit erratic twitchings; the individual may sway and even fall.

In both stuttering and shock when the reactions are very weak nothing more than an eye blink may be recorded. At these terminal points, the very weak and the intense reaction, the similarities are unmistakable. It is the middle ranges that usually present the dissimilarities. The differences in these ranges may be due to the stutterer's struggle with the contraction pattern and to the repetitions (biological preservations) which replace the linguistic response. This concept of biological replacing activities, repetitions and prolongations, cannot be dealt with further at this point but will be developed in a later paper.

In addition to the influences mentioned above as responsible for differences between the startle pattern and stuttering the following factors may be noted: alteration of the startle pattern by its intermittent disturbance of vocalization; interruption of behavior occurring in a highly complex situation, where, therefore, the interruption imposes replacing activities upon

those speech-movements-in-progress; the mere recurrence of situation after situation in which these compulsive reactions occur strongly associates them with speech and speaking situations; anticipation of the occurrence of stuttering puts the organism under tension which alters the normal shock pattern; the struggling of the individual with the tensions which continue into the post-shock period give much of the basis for individuality of action during stuttering, and these actions may also afford stimuli for further emotional reactions.

IX. Summary

Common characteristics of adult stutterers were shown to be few in number. They probably consist of a sharp inspiratory gasp, an eye blink, and certain tonic and clonic contractions of the speech musculatures. Other unusual breathing reactions of stutterers, aside from shallow respiration, were maintained to fall within three categories: (1) oppositions, (2) differences in movement patterning and (3) atemporal synchrony.

Cardiovascular reactions preceding, during and following blocking were considered under the following headings: heart rate, blood pressure, sinus arrythmia, the Valsalva reflex and vaso-motor changes. These activities, while often treated as isolated, discrete phenomena, were integrated into a meaningful physiological picture of stuttering.

The various studies concerned with tonus, although scattered and discrepant, together with findings indicative of muscular tension, were organized. Evidence was presented which indicated that stutterers' difficulties in non-speech behaviors may be partially traced to heightened tonus.

Tonus condition, reflex and eye-movement peculiarities, as well as respiratory and cardiovascular reactions during stuttering, were compared with similar measures taken on normal speakers during startle. The marked similarities in reaction were adjudged sufficient evidence to warrant the interpretation that stuttering consists of a startle contraction pattern. The contractions, mentioned as replacing activities, were asserted to occur when the particular individual is thrown out of psychological contact with the specific situation.

X. Conclusion

For centuries there has been going on a search for some anatomical or inner condition which would set the stutterer apart from the normal speaker. Reactions and behavior of the stutterer have been looked upon as being symptomatic of an inner condition. The condition has been assumed to be expressed through disruptions in speech and other behavior. (Workers who demand some special, inner physiological or psychological condition are not all of a past generation; even today the mystics remain in great number.)

Because stutterers as a group evidenced rather similar behaviors and reactions, the *deus ex machina* necessarily had to be some unknown operator which was possessed (albeit unwillingly) by stutterers in common. Complication was added, and the universal nature of stuttering attested, when speech interruption was found to occur in many races of man.

An agent in the form of an inner condition, either physiological or psychological, is still as distant from discovery as it was four thousand years ago. Advances in theory have only been attained through recognition of situational influences on behavior. Given an intact organism, and reasonably healthful physiological conditions, nothing other than situational influences are available for treatment.

The violence of stuttering indicates that in general the situational influences must be severe (as described above the inception of stuttering may involve shocking circumstances or merely interference between linguistic responses; nevertheless in so-called secondary stuttering stimulational conditions appear to be severe). Speech disruption of this nature is not mere habit. If a person's attention is directed toward an habitual response he can perform it slowly. The naive stutterer can stop his blocking, but he cannot stop it nor can he perform the movements slowly if forced to continue speech. Again, stuttering cannot be classed with the usual compulsions, for in the latter spasmodic reactions are absent.

In this paper the basic mechanism of stuttering (a mechanism because it is originally physiological) is considered to be the contraction pattern of shock, startle or surprise. The contractions appear when the individual is thrown out of contact with the situation. They occur when he cannot immediately adjust to urgent circumstances, when a response fails, or when the situation is evaluated as catastrophic.

Such an emotional reaction is universal. It requires no explanation upon a particular group basis. Being set in a behavioral context it is not of mystical character, and it is amenable to incorporation into an individual's daily life. The unusual fear exhibited by stutterers becomes more comprehensible when the non-psychological aspect of stuttering is considered; the break in behavior, the very catastrophic nature of the reaction (in addition to the social stigma) affords a somewhat different and realistic approach to the dread of disruptive speech.

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A STUDY OF THE MECHANISM OF VELOPHARYNGEAL CLOSURE[1]

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I. INTRODUCTION

Modern investigators hold that velopharyngeal closure involves two aspects, palatal and pharyngeal. Until about fifteen years ago it was believed that palatal movement accounted for almost all velopharyngeal closure. It has been known, however, since 1862, that during velopharyngeal closure the superior constrictor muscle contracts and pulls the back wall of the pharynx somewhat anteriorly, thus creating a bulge at the level of the anterior arch of the Atlas. The bulge has been called Passavant's cushion or pad, so named for the man who first described it in any detail.

During the last decade in particular, it has become the opinion among many oral surgeons that velopharyngeal closure is accomplished in large part by the action of the pharyngeal part of the nasopharyngeal sphincter. It is currently thought that, in addition to the upward and backward movement of the soft palate and the anterior movement of the back wall of the pharynx, there is also a considerable mesial movement of the lateral walls of the pharyngeal tube. That is to say, velopharyngeal closure is now thought to be a sphincter-like movement. The investigations of Dr. W. E. M. Wardill in England and Dr. George M. Dorrance in America have advanced and supported the present concept.

This study was undertaken with problems of particular interest to the speech pathologist in mind. One of these problems has been well summarized by Koepp-Baker (8):

> In most of the discussions which are generally accessible to the speech worker, the mechanism of velopharyngeal closure involved in the acts of speech, swallowing, and coughing, is made a remarkably simple affair. The speech student is accustomed to the typical cross-section diagrams of the speech mechanism used to illustrate phonetic positions. Constant experience with such diagrams helps him but little to develop the imagery necessary to understand the complex structures and movements which occur in speech. Since he sees the speech structures from only one or two static aspects, he comes to think of the activities of these structures as consisting of simple one-or-two-directional movements.
>
> Unless he has had experience in dissecting the human tissue, he is

[1]This paper constitutes in substance a dissertation submitted for the degree Doctor of Philosophy in the Department of Speech in the Graduate College, State University of Iowa, 1944. The study was directed by Professor Charles R. Strother. Invaluable support and technical counsel by the following State University of Iowa faculty members are gratefully acknowledged: Dr. Dean M. Lierle, Head of Department of Oral Surgery and Otolaryngology; Dr. W. R. Ingram, Head of Department of Anatomy; and Dr. L. B. Higley, Head of Department of Orthodontia.

unaware of the complexity of the structures, and he is unable to visualize the synergic relationships of parts. Since many of the structures whose activity he wishes to understand are relatively inaccessible to direct visual inspection, he cannot check his imagery by actual examination. Should his interest have carried him beyond the simplified phonetic diagrams, it will be seen . . . that even the classical anatomical descriptions and illustrations have not been helpful.

The speech pathologist has more than an academic interest in the mechanism of velopharyngeal closure. One need not be a veteran clinician to become aware of an apparent paradox. On the one hand are those repaired cleft-palate patients with seemingly adequate palatal closure who, after months of intensive speech drill, still exhibit pronounced nasalization on phonation. Contrast these with those few individuals, who, in spite of a wide unrepaired cleft of the velum, talk with remarkably little nasalization. It becomes obvious that the speech clinician has much to learn from a comprehensive study of the mechanism of velopharyngeal closure.

II. Statement of Purpose

The purpose of this investigation was: (1) to describe certain of the muscular relationships in normal palates and pharynges; (2) to study velopharyngeal activity in a normal and in several abnormal mechanisms during the production of certain speech sounds.

This investigation involved, therefore, a study of the anatomy and physiology of velopharyngeal closure. Three general methods were used to attack the problem. Each will be discussed separately.

III. Anatomy of the Nasopharynx

The formation now known as Passavant's cushion was illustrated by Sandifort (4) as early as 1805. However, it remained for Passavant (10) to describe the structure, which he did in 1862. Passavant explained the formation of the pad-like structure on the back wall of the pharynx at the approximate level of the tubercle of the arch of the Atlas in terms of the action of the pterygopharyngeus portion of the superior constrictor muscle.

Voltolini (12) in 1879 emphasized the part played by the superior constrictor muscle during velopharyngeal closure. He maintained that the contraction of the superior constrictor muscle is continued into the soft palate through the activity of the levator palati and the palatopharyngeus muscles. Falkson (6) in 1880 agreed, in essence, with Voltolini's point of view.

Negus (9) also maintains that the soft palate does not act alone in effecting velopharyngeal closure. He says:

> What actually happens is that the superior constrictor contracts together with the levator palati in order to close the orifice of the nasopharynx.

Closure takes place by a sphincteric muscular action in which the soft palate is elevated; not only does the palate rise, but the posterior and lateral walls move also, all towards one another. This mechanism gives rise, to the appearance of what is known as Passavant's cushion.

Thus authoritative opinion is agreed that velopharyngeal closure is accomplished by the upward and backward pull of the soft palate and by the inward movement of the back and side walls of the pharyngeal tube at the level of the pterygopharyngeus division of the superior constrictor muscle.

Wardill and his associates **(13, 14, 15, 16, 17)** and Dorrance **(4, 5)**, working independently, have done considerable work in tracing the exact anterior attachments of the pterygoid division of the superior constrictor. These writers found that in addition to its attachment at the medial lamina of the pterygoid plate and its hamulus, the pterygopharyngeus division of the superior constrictor also has an attachment in the aponeurosis of the soft palate. It was not known, however, whether these palatal fibers were typical or atypical findings. This study attempted to supply that information.

The anatomically oriented reader will recognize that a palatal origin of the superior constrictor must necessarily be mesial to its hamular origin. Thus, if such an origin does exist, the action of this part of the muscle would be to exert greater inward pull on the side walls of the pharynx than would be the case if only the hamular origin existed. Hence the assurance that a palatal origin of the superior constrictor muscle commonly exists would provide a sound anatomical basis for the point of view that extensive mesial movement of the lateral walls of the pharynx does occur during velopharyngeal closure.

IV. Anatomical Studies

Materials and Methods

The head and neck regions of ten cadavers were obtained through the Department of Anatomy, College of Medicine, State University of Iowa.

The heavy muscles and fascia at the base of the skull were severed. The head was disarticulated from the spinal column. The remaining structures in the neck were then severed from the body at the level of the inferior border of the cricoid cartilage of the larynx.

The pharyngeal tube which could now be seen was split along the posterior median line from the larynx up to its attachment at the base of the skull. By spreading the split edges of the pharynx outward a view could be had of the naso-, oro-, and laryngo-pharynges.

The mucous membrane lining the inner surface of the pharynx and the pharyngeal aponeurosis were removed, exposing the muscle fibers. The superior constrictor muscle was traced from its cut edge forward toward its origin on either the right or left side, depending upon which side was used. As the dissection continued forward, the pterygopharyngeus muscle was separated from the palatopharyngeus. The dissection was carried forward until progress was interrupted by the crossing of the levator palati and also of the salpingopharyngeus muscle when present. To permit closer dissection of the superior constrictor muscle,

the levator and salpingopharyngeus muscles were cut. The superior constrictor could then be traced forward to its origins. Part of the detailed work was done with the aid of a dissecting microscope.

Results

Muscular relationships in this region are subject to wide variations. Results of the dissections carried out in this study indicate that variation occurs both in total muscular development and in the dispersion of specific muscle fibers.

In every case the superior constrictor muscle had an origin at the pterygoid hamulus. In eight of the ten dissections a palatal origin of the superior constrictor was also found. This origin consisted in seven cases of a thin band of muscle fibers found at the top of the superior constrictor which ran from the palate just inferior to the point where the levator palati inserted into the palate. In one case the palatal division comprised the larger part of the pterygopharyngeus muscle.

In three cases the palatal division of the pterygopharyngeus consisted of an entirely distinct sheath which was somewhat external to the hamular division on the lateral walls, but which passed mesial to the hamulus. In two cases the internal sheath was invested by the middle constrictor. The external sheath appeared to join the middle constrictor on its outer surface, although it may be that it continued in the superior constrictor and interdigitated in the median raphe.

It seems significant that in eight of ten cases a palatal origin of the superior constrictor was found to exist. Neither Dorrance nor Wardill indicated how many dissections were undertaken in their studies. It might, therefore, have been suggested that the palatal origin occurred in only a few cases. However, these results would seem to indicate that the palatal origin occurs more frequently than not.

What may be even more significant for our purposes and which, to the writer's knowledge, has not been reported previously, was a consistent interconnection between the palatopharyngeus and the pterygopharyngeus muscles. This occurred by means of many individual fibers rather than through a large separate strand. In most cases the connection between the muscles was so close that it was almost impossible to separate the two. These interconnecting fibers may be thought of as having their origins in the palatopharyngeus or ultimately, perhaps, in the aponeurosis of the soft palate. It was not possible, however, to trace them into the palate. The reader familiar with the anatomy of this region will remember that the pterygopharyngeus, as it inserts into the median raphe, is much larger than it is at its origin at the hamulus. Moreover, the few fibers which enter the superior constrictor directly from the palate will not account for this difference. The number

of fibers from the palatopharyngeus which join the superior constrictor is quite sufficient to explain the difference.

Mention is made of these connections because of their possible rôle during velopharyngeal closure. It is generally agreed that at least one function of the palatopharyngei is to approximate the posterior arches of the fauces. If, then, muscular connections exist between the palatopharyngei and pterygopharyngei, the lateral pharyngeal walls may actually be drawn mesially during velopharyngeal closure by contraction of the palatopharyngei.

A third muscle which was studied was the salpingopharyngeus. (In two specimens the muscle was absent.) This muscle makes up a part of the lateral pharyngeal walls. Its origin is at the eustachian orifice. The main body of the muscle inserts into the lateral walls of the pharynx itself. A few fibers are usually continuous with the palatopharyngeus muscle in the soft palate. Because of these relationships this muscle may be of some importance in mesial pharyngeal movement. The salpingopharyngeus muscle may also help to elevate the soft palate.

Summary and Conclusions

Detailed dissections of the soft palates and pharynges of ten cadavers were undertaken. The purpose was to attempt to investigate the palatal origin of the pterygopharyngeus muscle. The palatopharyngeus and salpingopharyngeus muscles were also studied.

In eight of ten cases a palatal origin of the pterygopharyngeus muscle was found to exist. In the majority of cases this bundle consisted of a small strand of fibers which originated near the insertion of the levator palati in the palatal aponeurosis. In all cases a hamular origin to this muscle was found. The hamular origin was the better developed and was just inferior to the smaller palatal origin.

In eight of ten cases there were muscle connections between the palatopharyngeus and the pterygopharyngeus muscles.

It was observed that there is considerable variability in general muscular development in this region of the anatomy.

Results of this study suggest the following conclusions:

1. In addition to their hamular divisions, the pterygopharyngei were found to receive fibers which originate in the soft palate.
2. The palatal fibers of the pterygopharyngei may contribute to mesial movement of the pharyngeal walls during velopharyngeal closure.
3. Muscular connections between the palatopharyngeus and the pterygopharyngeus muscles normally exist.
4. Because of these connections, the approximation of the

palatopharyngei during velopharyngeal closure may contribute to the mesial movement of the lateral pharyngeal walls.

5. In addition to their insertions into the lateral pharyngeal walls, the salpingopharyngeus muscles may occasionally send fibers to the soft palate.

6. The salpingopharyngeus muscle may contribute to velopharyngeal closure by creating an in-bulging of the lateral pharyngeal walls. This muscle may also contribute slightly to the elevating of the soft palate.

V. Studies of Velopharyngeal Activity

Introduction

The purpose of this section of the investigation was to supplement the anatomical data and their theoretical physiologic implications by some considerations of velopharyngeal closure as it occurs during the process of phonation. Because it is seldom possible accurately to predict muscular function solely from the anatomical relationships as they appear in the cadaver, it was felt necessary to supplement the preceding anatomical study by observations of velopharyngeal activity in living subjects.

Over a period of approximately one year, patients in the Department of Otolaryngology of the University Hospital were examined with reference to their suitability for such study. Ultimately, five subjects were obtained with whom it was possible to study velopharyngeal activity during phonation.

The first subject, identified as subject A, was a white male, sixty-eight years old. (See Fig. 1.) Because of carcinoma a radical resection of the left maxillary sinus had been done. The nasal septum remained intact. Also remaining was the posterior tip of the left inferior turbinate bone, or concha. By illuminating this cavity a view could be had of the left nasal fossa and a portion of the nasopharynx, including its posterior and left lateral walls, as well as the superior surface of the velum, when elevated. The movement of these structures was photographed.

Subject B was a white female, twenty years of age, who had a wide central cleft of the palate, extending back from a point three centimeters behind the alveolar ridge. (See Fig. 2.) A prosthetic appliance covered the cleft of the hard palate, but there was a wide unrepaired cleft of the velum which made the posterior and lateral pharyngeal walls accessible for photographic study.

Three subjects, one of whom had a wide unrepaired cleft palate, another an inadequate repair of the soft palate, and the third a well-repaired cleft of the palate, were available for X-ray study of the action of the posterior pharyngeal wall.

Because of anatomical differences between the subjects, as well as differences in techniques of study, these cases will be discussed separately.

VI. A Photographic Study of a Normal Nasopharyngeal Mechanism: Subject A

Photographic Procedures

Sixteen-millimeter color motion picture film was used for photographing. The subject was seated in a medical examination chair equipped with a head rest, which was adjusted to afford as precise a control over the head movement as was possible. The camera was mounted on a stand about twenty-four inches from and level with the particular part in focus.

It was desired to photograph both the vertical movement of the velum and the mesial movement of the pharynx during phonation. These structures could not be pictured simultaneously. Hence it was necessary

Figure 1. Photograph of subject A to show the general external appearance. This picture was taken prior to the completion of the operation.

Figure 2. Photograph of the mouth of subject B to show the general appearance of the structures at rest. The palatopharyngei are seen on either side of the cleft. Immediately behind the incisor teeth can be seen the prosthetic appliance.

to photograph them separately from slightly different angles. To picture velar activity, the camera was placed approximately level with the hard palate and at a distance roughly thirty degrees to the left of the median sagittal plane of the skull. Presence of the nasal septum, which was intact, necessitated photographing at this angle. To photograph lateral movement of the side walls of the nasopharynx, the camera was placed in the sagittal plane, slightly to the left of the midline of the skull.

Velopharyngeal activity was photographed during phonation of the following sounds: [i], [æ], [ɑ] and [u]. The subject was drilled on production of these sounds prior to their "photographing." Three phonetically-trained observers agreed upon the accuracy of the sounds before the

structures were photographed. The camera, which was trained upon the back wall of the pharynx in line with the soft palate, was then started, and the subject pronounced the first vowel, which was [i], twenty-one times at the rate of one vowel a second. This procedure was repeated for [æ], [ɑ] and [u]. Following a brief rest period, the same procedure was repeated while the camera was focused on the left lateral wall of the naso-pharynx. During the entire photographing the observers were checking each sound to note that it lay within its own phoneme.

General Measurement Procedures

In order to approximate life-size measurements, with each set of pictures a millimeter rule was photographed at the focal point. Pictures were placed in a regulation sixteen-millimeter projector which was moved closer to or farther from the screen until the image of the rule corresponded exactly in size with an actual rule held at the side of the image.

The film was not marked during any of the measuring procedures. Images were cast upon a screen on which was fixed a piece of paper. After reference lines had been established, all tracing was done on the paper. A new paper was used for the complete movement of each sound—from rest to greatest movement to rest again. The film was drawn through the projector, frame by frame. At each frame the reference points were lined up with the tracings on the paper. As the particular structure grew progressively higher during phonation, its image was traced on paper. This method involved the individual study of approximately 2,500 photographs. All measurements were made with a millimeter rule.

Measurement of Velar Movement

The establishment of suitable reference points from which to make measurements of movement is of prime importance in this type of study. After considerable trial-and-error, several points were found which proved to yield very reliable measurements. This was particularly true of the pictures of velar activity.

Although the posterior border of the nasal septum is in reality concave in shape, the angle from which these pictures were taken made it appear to be virtually straight. By drawing a line through two points on this border, the first reference line was established. All measurements of velar elevation were made parallel to this line. Perpendicular to the first reference line and at the point on the hard palate where the soft palate dropped below view, a second reference line was erected. For the pictures of velar activity, this was the base line, the line from which movement upward was measured. However, in view of the fact that this line was obliterated when the palate began to rise, another point also had to be designated. This was that point at which the inferior border of the inferior concha joined the lateral wall of the nasal fossa. A line perpendicular to the nasal septum was also run through this point. (See Figs. 3 and 4.)

To test the reliability of these reference points a random sample of velar movements was remeasured. This involved the entire procedure, including the erection of all reference lines. The Pearson Product-Moment method yielded a reliability coefficient of .997.

Measurement of Pharyngeal Movement

Reference points for mesial movement of the lateral walls were less well defined. The posterior border of the septum could not be used as a reference mark in these pictures because of the angle from which the pictures were taken. One reference line, approximately vertical, was drawn through two points in the nasal fossa. These points were on the lateral nasal wall, just superior to the remainder of the inferior concha. Perpendicular to this line was erected another which went through the point where the superior border of the inferior concha joined the lateral wall

TABLE I. MEANS, STANDARD DEVIATIONS, AND RANGES FOR SUBJECT A.

Velar Movement in Millimeters				Pharyngeal Movement in Millimeters, Positions 1 & 2							
				[i]		[æ]		[a]		[u]	
[i]	[æ]	[a]	[u]	1	2	1	2	1	2	1	2
6.50	6.00	2.25	9.00	3.00	4.75	0.75	1.00	1.25	1.50	4.00	6.00
6.00	2.75	2.25	7.50	3.00	4.25	0.50	1.00	0.50	1.00	3.50	5.00
6.50	4.50	3.75	9.00	2.75	4.00	1.00	1.50	0.25	0.50	3.25	5.00
7.00	4.50	2.25	8.50	3.00	4.75	0.75	1.75	1.00	1.00	3.00	5.00
6.50	4.00	2.50	8.50	3.00	4.00	2.00	2.75	1.00	1.00	3.00	5.00
5.75	4.00	2.00	8.25	3.00	4.00	1.00	2.00	1.00	1.50	3.00	4.00
5.50	2.75	2.00	7.25	2.25	4.25	2.25	3.75	0.00	0.50	3.50	4.75
6.00	4.00	3.25	7.50	2.00	3.00	1.25	2.00	0.75	1.00	2.25	3.75
6.00	3.50	2.50	7.00	2.00	3.75	0.75	1.25	0.75	1.00	2.50	4.00
6.00	3.25	4.75	8.00	2.25	3.75	0.50	1.00	0.75	1.00	2.00	3.00
6.25	3.00	3.00	6.50	1.50	3.00	1.00	1.50	1.00	1.00	2.50	3.50
4.75	3.00	2.00	7.50	1.50	3.00	1.75	2.25	0.75	0.75	2.00	3.75
6.25	3.75	3.00	6.50	2.00	2.75	1.25	2.00	1.00	1.75	3.00	4.50
6.00	2.75	4.00	8.00	2.00	3.00	1.50	2.00	0.50	1.00	2.75	4.25
6.50	3.00	2.50		2.50	3.75	1.25	1.50	0.25	0.75	2.50	3.75
6.25	3.50	2.00				1.00	1.75	0.75	1.00	2.00	4.00
6.00		2.00						1.00	2.00	1.75	3.50
6.75		2.50						0.75	1.25		
6.00		1.50						1.25	1.50		
5.50		2.00						0.50	1.00		
4.50								1.00	1.50		
N 21	16	20	14	15	15	16	16	21	21	17	17
Mean 6.02	3.64	2.60	7.79	2.38	3.73	1.16	1.81	0.76	1.12	2.74	4.28
SD 0.621	0.841	0.788	0.746	0.546	0.648	0.482	0.694	0.327	0.372	0.588	0.734
Range											
from 4.50	2.75	1.50	6.50	1.50	2.75	0.50	1.00	0.00	0.50	1.75	3.00
to 7.00	6.00	4.75	9.00	3.00	4.75	2.25	3.75	1.25	2.00	4.00	6.00

of the nasal fossa. The left lateral wall of the nasopharynx at rest was also traced in. As the wall was displaced mesially, its new position was traced on the paper until its farthest mesial movement had been recorded for each sound.

In each case measurements were made at two points, one along the line running through the superior border of the inferior concha, position one, the second at a point five millimeters below this line, position two. Remeasurement yielded a reliability coefficient of .926 at position one, and .973 at position two for a random sample of one-third of the phonations.

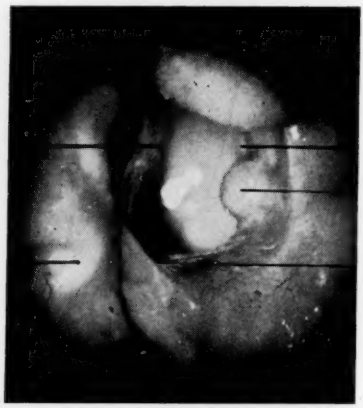

Figure 3. Anterior view of the left nasal fossa and nasopharaynx of subject A.

Results

The first point considered was the extent of velar movement, which was measured with a high degree of reliability, using the points previously described. The data in Table I indicate that mean extents of movement ranged from 2.60 millimeters for [*a*] to 7.79 millimeters for [u].[2] The height of the velum increased progressively from [*a*] to [æ], to [i], to [u] Differences in height between these sounds were all statistically significant except for the difference between [*a*] and [æ].

The amount of mesial movement is also shown in Table I. The means ranged from .76 millimeters for [*a*] at position one to 2.74 millimeters for [u] at position one; from 1.12 milli-

[2]It is not intended that measures reported in this study should be considered as absolutes. The biggest factor negating that possibility was the lack of adequate control over the height of the camera and the angles at which the pictures were taken. It is only possible to make comparisons between sounds at any one position. Measures reported are chiefly for comparative interest.

meters for [*a*] at position two to 4.28 millimeters for [u] at position two. It will be remembered that position one is located at the superior aspect of the inferior concha and that position two was arbitrarily set five millimeters below position one. In all cases movement at the second (lower) position is greater than at position one.

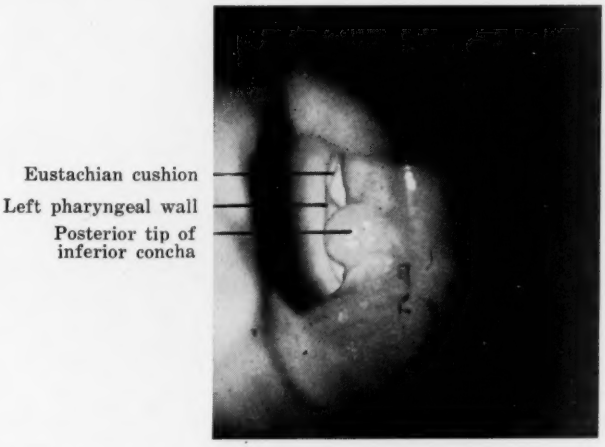

Figure 4. Anterior view of the left one-half of the nasopharynx of subject A at rest to show the relationship of the left pharyngeal wall to the eustachian cushion and to the posterior tip of the inferior concha.

These results indicate that the involvement of the lateral walls of the nasopharynx in velopharyngeal closure is considerable. Inspection of the pictures, of which Figure 5 is typical, also indicates that the major part of this mesial movement is not a continuation of Passavant's pad in a narrow shelf-like projection, but rather that it is a broad in-bulging of the lateral pharyngeal wall which extends from as high as the level of the posterior tip of the inferior concha. The fact that mesial movement was greater at position two, a lower level, than at position one would seem to suggest that movement might have been even greater at a point lower in the pharynx. The velum interfered with further observation, as Figure 5 will show. The observed high level at which mesial movement occurs and the possibility of further movement of the lateral walls at a lower level suggest that velopharyngeal closure, contrary to general opinion, is not accomplished simply by a sphincteric mechanism.

It will be recalled that in the previous section several

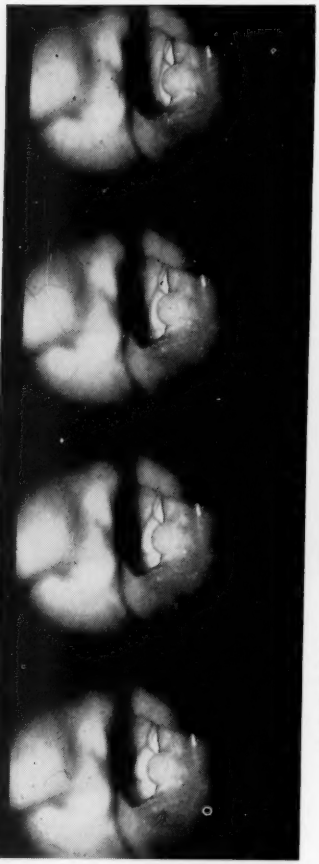

Figure 5. A series of frames from the motion picture film to show the action of the left lateral pharyngeal wall and velum from rest through the first stages of elevation. Read from top to bottom. See Figure 4 for identification of important structures.

Fig. 6. Photograph of the mouth of subject B during phonation to show (1) the right pharyngeal wall, which is just posterior and mesial to the right palatopharyngeus muscle; (2) Passavant's pad, which can be identified on the posterior pharyngeal wall.

muscles which might account for movement of the lateral walls were mentioned. The action of the palatal fibers of the pterygopharyngeus muscle was especially stressed. Results of the present study show that mesial movement is more extensive than can possibly be accounted for solely in terms of the action of fibers of the superior constrictor muscle.

Also discussed in an earlier section was a muscle, the relationships of which may readily explain the movement as pictured in the present study. This is the salpingopharyngeus muscle, the origin of which is at the orifice of the eustachian tube, and whose insertions occur in the lateral walls of the pharynx and in the soft palate. Careful observations of the anatomical landmarks as revealed by illustrations accompanying this section will dispel any doubt concerning the rôle of the salpingopharyngeus muscle in the mesial movement of the lateral walls of the pharynx.

At first thought it would appear that any mesial movement of the lateral walls of the nasopharynx occurring at the level of the posterior tip of the inferior concha would be so high that participation of the superior constrictor muscle would be unlikely. It will be remembered that fibers were reported originating in the palatal aponeurosis and inserting along the superior border of the superior constrictor muscle. Attachments of these palatal fibers were described in close approximation to the insertion of the levator palati muscle. It follows that, because of their upward pull on the velum, the levator muscles cause the tissue immediately surrounding their insertions to be the most highly elevated. This particular area includes the palatal fibers of the superior constrictor muscle. It would thus appear that the presence of fibers of the pterygopharyngeus muscle in the velum may partially account for the mesial movement of the pharyngeal walls which occurs at the level of the greatest velar height.

VII. A Photographic Study of an Abnormal Nasopharyngeal Mechanism: Subject B

Photographic Procedures

Sixteen-millimeter color motion picture film was used to photograph subject B. This subject was not ambulatory at the time the pictures were taken. The head of her bed was elevated, and a pillow was placed under her shoulders and neck so as to tip the head backward, thus permitting a view of the nasopharyngeal mechanism. The writer held his hands over the subject's forehead to maintain control over head movement. This position undoubtedly afforded a better and more stable view than would have been possible in an upright position. The camera was placed at a distance of about twenty-four inches from the back wall of the pharynx and in the median sagittal plane.

Inasmuch as photography occurred through the mouth, it was impossible to use all the sounds that were used for subject A. It is quite obvious that the tongue and lips would obscure pharyngeal activity on both [i] and [u]. Hence only [ɑ] and [æ] were used. Number of repetitions for [æ] was fourteen and for [ɑ] nine. Other photographic procedures were similar to those described in the previous study.

General Procedures

A millimeter rule was also photographed at the focal point in order to approximate life-size enlargements for measuring. General measuring procedures were similar to those described in the previous study. This investigation involved the study of some 1,300 individual photographs.

Measurement of Pharyngeal Movement

A horizontal reference line was run through two points on two of the left and right maxillary molars. A vertical line which ran through the space between the two upper central incisors was constructed perpendicular to this horizontal line. The mesial borders of the palatopharyngei at rest were also traced in. Only the right lateral wall was used in measuring pharyngeal movement, because the view on the left side was somewhat obscured by the palatopharyngeus muscle. Measurement was made from the position of the mesial border of the right palatopharyngeus muscle at rest to the most mesial extent of the lateral wall during phonation. Measurement was made along a line parallel to the horizontal reference line. All measurements were made twice, and the coefficient of reliability for these reference lines was .904.

TABLE II. MEANS, STANDARD DEVIATIONS, AND RANGES FOR SUBJECT B.

	Lateral Movement of Palatopharyngei in Millimeters				Mesial Movement of Right Lateral Wall in Millimeters	
	[æ]		[a]		[æ]	[a]
	Right	Left	Right	Left		
	1.00	0.75	0.25	1.00	2.00	3.00
	0.00	0.00	0.00	0.75	2.00	3.00
	0.00	0.00	0.25	0.00	2.25	2.75
	1.50	0.75	0.50	0.50	1.75	2.00
	1.00	0.75	0.00	0.50	2.00	3.00
	0.25	1.50	0.00	0.75	2.00	3.25
	0.00	1.50	0.00	2.25	0.75	2.00
	0.50	1.00	0.00	0.75	2.00	3.50
	1.50	1.75	0.75	1.00	1.00	2.75
	1.00	1.00			1.50	
	1.75	1.00			0.75	
	1.00	1.00			0.00	
	1.50	0.75			2.25	
	0.75	1.50			2.75	
N	14	14	9	9	14	9
Mean	0.8393	0.9464	0.1944	0.8333	1.6429	2.8056
SD	0.5871	0.5016	0.2577	0.5774	0.7239	0.4826
Range						
from	0.00	0.00	0.00	0.00	0.00	2.00
to	1.75	1.75	0.75	2.25	2.75	3.50

Measurement of Palatopharyngeal Movement

Originally it was intended to study only the extent of mesial movement of the lateral walls of the nasopharynx. It became evident, however, that in addition to this mesial movement on phonation, there was also evidence of lateral movement of the palatopharyngei during phonation. Consequently it was also decided to study movements of the palatopharyngei. The same reference points were used for these measures as were used for measures of pharyngeal movement. Measurements were made from the rest position of the palatopharyngei to their farthest lateral extents. Measurements were made parallel to the horizontal reference line at a height arbitrarily set at the level of the most mesial bulge of the lateral wall of the pharynx. All measurements were repeated with a reliability coefficient of .867.

Results

Subject B was studied with reference to mesial movement of the right lateral wall of the pharynx and to lateral movements of the palatopharyngei.

Table II indicates that the mean extent of *lateral* movement of the palatopharyngei ranged from .1944 millimeters on the right side for [*a*] to .9464 millimeters on the left side for [æ]. Mean amount of mesial movement of the right pharyngeal wall ranged from 1.6429 millimeters on [æ] to 2.8056 millimeters for [*a*]. It is not possible to compare subjects A and B in regard to absolute amounts of pharyngeal movement, because in subject B only the movement mesial to the palatopharyngeus muscle could be measured. With subject A the entire extent of the mesial movement could be observed.

It is of interest, however, to compare subjects A and B with reference to *relative* amounts of pharyngeal movements on the vowels [*a*] and [æ]. The results are inconsistent, a fact which represents either an individual difference or a systematic difference between the physiology of normal and cleft palates. In this connection it was noted that Wolfe (18) found considerable variability among his group of normals. Hence it is possible that the difference reported in the present study is an individual difference.

Results of this study add to our understanding of the mechanism acting in movement of the lateral pharyngeal walls. In the previous section it was stated that mesial movement should not be considered as a continuation of Passavant's cushion, which appears on the posterior wall of the pharynx. It was pointed out that mesial movement of the pharyngeal walls apparently extends over a considerable vertical distance. Mesial movement begins as high as the orifice of the eustachian tube. It was also stated that movement may actually become more extensive lower in the pharyngeal tube. In view of the observed activity and the anatomical relationships, it was said that the salpingopharyngeus muscle was mainly responsible for the movement of the lateral pharyngeal walls.

The pictures of subject B taken at a lower level in the pharynx showed substantially the same muscle movement. Figure 6 indicates the degree of muscle contraction observed during phonation. On the left side of the picture, immediately posterior and mesial to the palatopharyngeus muscle, can be seen the fold of mucosa which overlies the salpingopharyngeus muscle. It should be observed that this fold, which comprises the inward extent of the lateral wall, is not continuous with Passavant's cushion, which is to be identified on the posterior pharyngeal wall. The second point of interest is that, although the upper extremity of the salpingopharyngeal fold is hidden from view, the lower part is seen to join the lateral pharyngeal wall some distance below Passavant's cushion. Thus, by putting

together the results of studies of subjects A and B it is seen that this mesial movement of the salpingopharyngeus muscle extends from very high in the nasopharynx to a point somewhat below the anterior bulge of the posterior pharyngeal wall. This is further evidence to support the statement made in the previous section, namely, that velopharyngeal closure is not accomplished by a simple sphincteric mechanism. Unfortunately, the presence of the palatopharyngeus muscle negates the possibility of determining how much mesial movement occurs at the lower level. Hence it is impossible to determine whether movement of the lateral wall was actually greater at this lower level than at the level of the elevated velum, as the study with subject A would seem to suggest.

VIII. An X-Ray Study of Velopharyngeal Closure

Introduction

In an effort to obtain information concerning the action of the posterior wall of cleft-palate subjects during velopharyngeal closure, an X-ray study was undertaken.

Blair and Brown (2), among others, have suggested that in the absence of adequate velar movement during velopharyngeal closure the superior constrictor may compensate by overacting to create an extensive bulge of Passavant's cushion.

Subjects

Three subjects were used for this study. All had cleft or repaired palates. The voices of two were decidedly nasal; the quality of the third voice was moderately nasal. Subjects included: (1) A nineteen-year-old female whose palate had been repaired during early childhood. However, the sutures in the soft palate had torn out, and the soft palate was again cleft. There was also a hole about one centimeter in diameter just behind the alveolar ridge in the midline of the palate. Her voice was very nasal. (2) Subject B was discussed in the previous section. She was twenty years old and had a wide cleft of the palate beginning about three centimeters behind the alveolar ridge. The hard palate was covered by a prosthetic appliance. Her voice was also extremely nasal. (3) The third subject was a thirteen-year-old male who had a seemingly adequate repair of both the hard and soft palates. Voice quality of this subject was moderately nasal.

Apparatus

The X-ray equipment was supplied by the Department of Orthodontia. The equipment, most recently described by Wolfe (18), consisted of a Victor X-ray machine with a five-inch spark gap. Exposure time was five seconds, using twenty-five milliamperes at 110 volts. The cassett target distance was five feet. Rays emitted from the machine passed through a hole in a lead plate which was fastened just anterior to the X-ray tube. The lead plate served to focus the rays mainly on the bony structures. The decrease in radiation decreased the penetrating power of those rays which struck the soft tissues. This apparatus made possible the adequate definition of the soft tissues without resorting to painting. However, for illustrative purposes a radiopaque substance consisting of barium and gum of acacia was used to spot the posterior pharyngeal wall. With this exception, no structures were painted.

The head of the subject was kept in lateral relation to the X-ray machine by a head-positioner, which consists of ear rods that insert into the external auditory canals of either ear. The position of the head is established upon the Frankfort plane by an orbital marker which is placed in contact with the lowermost point of the inferior border of the bony orbit. This equipment has been described more completely elsewhere (7, 18).

Experimental Technique

Each subject was photographed in three positions: a rest position; while phonating [*a*]; while phonating [u]. Two phonetically-trained observers agreed upon the adequacy of the vowels prior to and during X-raying. It was necessary for the subject to phonate for about seven seconds, but only the middle five seconds were used for the X-ray. The three pictures were taken during one sitting and without releasing the subject from the head-positioner. Elapsed time for each subject was ten minutes.

Tracing Procedure

A lighted surveying table was used to make all tracings. In order to facilitate a comparison between pictures, it was necessary to establish certain reference points. The main reference line was drawn through the anterior and posterior nasal spines. Perpendicular to this nasal line another line was erected which ran through the tubercle of the anterior arch of the Atlas. Also traced in were the posterior wall of the pharynx, the lips, teeth, and any other identifying structures. These lines were drawn on the tracing paper, not on the film itself. The films were not marked, except for two pinpricks placed along the nasal reference line but outside the head region. This was done to allow for checking by anyone else at a future time.

Measuring Procedures

Three measures were used. Two of these were similar to those used by Wolfe (18) in his study of normals. Those similar were (1) the distance from the tubercle of the Atlas to the back wall of the pharynx; (2) the distance of the anterior point of the bulge of the back wall above or below the tubercle of the Atlas. The first measure was made along a line running parallel to the nasal reference line and passing through the tubercle of the anterior arch of the Atlas in the anteroposterior aspect.

The limiting nature of the first measurement must be pointed out. All measures of the distance from the anterior arch of the Atlas to the back wall of the pharynx were made by Wolfe precisely at the level of the tubercle of the anterior arch of the Atlas. However, according to Wolfe's findings, the height of the most anterior extent of Passavant's pad during phonation varies considerably from subject to subject. The range was from 6.50 millimeters above the tubercle of the Atlas to 12.50 millimeters below this point. The standard deviation was over 4 millimeters. A better procedure, if one is interested in the greatest extent of anterior movement of the back wall, would be to make this measurement at the precise point of greatest movement. This was done in the present study. However, for comparative purposes the measurements at the tubercle of the Atlas were also included.

Results

The number of subjects used in this part of the study makes it impossible to do more than point up some possible trends. However, the study showed that the difference in anterior movement of Passavant's pad between [*a*] and [u] is not sig-

nificant. Although Wolfe did not use the vowel [u], he failed to find a significant difference in anterior movement of the posterior wall between [a] and [æ]. Hence it would appear that, in regard to differences in pharyngeal movements as between vowels, the results of the two studies are consistent.

The study also showed that the tubercle is not necessarily the level at which anterior movement of the posterior wall is greatest. Measures indicate that greatest movement occurred from 3.25 millimeters above the tubercle to 7.50 millimeters below. This range is consistent with that found by Wolfe. It is of interest to note that, although greatest anterior movement of the posterior wall may occur some distance above or below the tubercle of the Atlas, considerable movement of the pos-

Figure 7. X-ray showing the extent of anterior movement of Passavant's pad during the phonation of [a]. Passavant's pad is outlined in white and is shown just anterior to the anterior arch of the Atlas. The two vertical lines indicate the extent of anterior movement.

terior wall may also be observed at the level of the tubercle. This would seem to suggest that the anterior movement of the pharyngeal wall occurs over some vertical distance rather than at a strictly localized position. At the present time no comparison can be made between normal and abnormal pharynges with reference to the greater amount of movement at Passavant's pad. This study can only suggest that the movement of Passavant's cushion may be considerable in the individual with a cleft palate.

IX. The Nature of Velopharyngeal Closure

The modern concept of velopharyngeal closure is that it occurs by means of a sphincter mechanism. The upward and backward movement of the soft palate is said to comprise the anterior segment of this sphincter. Anterior movement of the posterior pharyngeal wall accounts for a part of the posterior, or "pharyngeal" segment of the sphincter. Furthermore, it has generally been concluded that the presence of fibers of the superior constrictor muscle in the soft palate would complete the sphincter and make possible the mesial movement of the lateral pharyngeal walls. This mesial movement has generally been considered to be an extension of Passavant's pad.

In an early section of this paper it was reported that muscle fibers of the superior constrictor muscle typically originate in the soft palate, as well as at the pterygoid hamulus. Muscular connections between the palatopharyngei and pterygopharyngei were also reported. The salpingopharyngei muscles were also studied with reference to their relationships both to the velum and lateral pharyngeal walls. It was concluded that all of these muscles may be active in producing mesial movement of the pharyngeal walls during velopharyngeal closure.

In addition to the anatomic investigation, three studies of velopharyngeal closure in living subjects were undertaken. In one subject, after removal of the cheekbone because of carcinoma, it was possible to take pictures from above the soft palate to study both velar and mesial pharyngeal movements. With another subject who had a cleft palate, pictures were taken through the mouth to study the action of the lateral pharyngeal wall at a lower level. To study the action of the posterior pharyngeal wall from a lateral position, an X-ray investigation was conducted with three subjects, all of whom had cleft or repaired palates. As the result of these studies it is now possible to submit a more nearly complete account of the nature of velopharyngeal closure than it has been feasible to do in the past.

Principally due to the action of the levator palati muscles the velum is raised and drawn backward to decrease the lumen of the nasopharynx in the antero-posterior plane. At the same time the posterior wall, mainly at the general level of the anterior arch of the Atlas, is drawn forward. The posterior wall may actually contact the superior surface of the velum. Whether it does or not depends upon the extent of velar movement, for although velar activity varies considerably during velopharyngeal closure, the extent of movement of the posterior pharyngeal wall, at least during speech, seems to be relatively constant.

Also occurring in velopharyngeal closure is considerable mesial movement of the lateral pharyngeal walls. It is believed

that both the hamular and palatal divisions of the pterygopharyngeus muscle exert some force in this mesial movement. Muscle connections between the palatopharyngei and the pterygopharyngei may also account for a certain portion of the mesial activity. However, because mesial movement of the lateral pharyngeal walls occurs over such a great vertical distance, the main contributor to this movement must be the salpingopharyngeus muscle. This muscle draws the lateral wall mesially, from as high as the orifice of the eustachian tube to slightly below the level of Passavant's pad. What is more, the extent of mesial movement bears a direct relationship to the extent of velar elevation during velopharyngeal closure.

In view of the fact that mesial movement of the pharyngeal walls occurs over considerable vertical extent rather than as a continuation of Passavant's cushion, it cannot be held that the mechanism acting to produce velopharyngeal closure is of the nature of a simple sphincter.

X. General Conclusions

Results of the anatomic and physiologic studies suggest the following conclusions:

1. Palatal fibers of the superior constrictor typically do exist and probably account for a part of the anterior and mesial movement of the pharyngeal walls.

2. Muscular connections between the palatopharyngei and pterygopharyngei typically do exist and may account for some of the mesial movement of the pharyngeal walls.

3. Anatomic relationships of the salpingopharyngeus suggest that this muscle probably acts to raise the velum and to move the lateral walls of the pharynx in a mesial direction.

4. Considerable mesial movement of the lateral pharyngeal walls was found to exist.

5. Mesial movement occurs over a considerable vertical extent. Movement may be greater at a lower level than at its highest position.

6. The amount of mesial movement is directly related to the extent of velar elevation.

7. Greatest extent of mesial movement appears to occur in the area overlying the salpingopharyngeus muscle.

8. Although there are significant differences between certain vowel sounds in regard to velar and mesial pharyngeal movements, these differences are not significant for the anterior movement of the posterior pharyngeal wall.

9. The velopharyngeal mechanism does not function as a simple sphincter.

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ASCA
News and Announcements

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The speech clinic of the University of Illinois, under the directorship of Severina E. Nelson, has started a program for conservation of hearing among the school children of Champaign County. This program is under the direction of Miss Marion Quinn, who has recently joined the staff of the speech clinic as supervisor of the deaf and hard-of-hearing. Miss Quinn is also supervising work for the deaf and hard-of-hearing in the Champaign school system. Miss Ruth Kern is the instructor.

A chapter of the Demosthenes Club has been organized by Professor Alan B. Clemons at the University of the Witwatersrand, in Johannesburg, South Africa. Mr. Clemons, who did graduate work at the University of Iowa, is in charge of the speech clinic at the South African institution.

The parent chapter of the Demosthenes Club was organized at the University of Iowa in 1939. It is an organization of the stutterers who are attending or who have attended the Iowa speech clinic. The club publishes a newsletter, *The Demosthenator*. Members refer to themselves as "Demosthenators," and to their speech difficulty as "demosthenating," taking these terms from the name of the Greek, Demosthenes, who, according to some writers, overcame a speech defect, and, according to practically everyone, became a great orator.

The American Society for the Hard of Hearing, Washington, D. C., observed its silver anniversary at the Waldorf-Astoria, New York City, November 10-12. Sessions were attended by representatives from communities throughout the United States, Canada, and the South American countries, and included discussion of medical, educational and rehabilitation aspects of hearing conservation. Special recognition was given to the pioneers who founded the society.

National Hearing Week, October 22-28, emphasized the theme of Twenty-five Years of National Service in the Cause of Better Hearing in editorials, feature articles, special publications, radio broadcasts and platform addresses at open meetings of the 118 chapters of the society throughout the country. In addition to the peace-time services of the society, in prevention of deafness and conservation of hearing, training and remedial programs, the war and post-war objectives of the society include special work with deafened veterans in lip reading and vocational rehabilitation guidance.

(Continued on Page 356)

THE APPLICATION OF SOUND DISCRIMINATION TESTS TO FUNCTIONAL ARTICULATORY DEFECTIVES WITH NORMAL HEARING[1]

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I. INTRODUCTION

The chief operational difference between a functional articulatory defective[2] and a normal speaker is that of adjustment of the normal speech articulatory organs. It has long been thought that an etiological factor in this failure to adjust and coordinate the audio-voco-motor system is resident in an auditory deficiency—an inability to discriminate between the sounds of speech. A relationship between speech and hearing has long been known to exist. The amount and effect of this relationship is observable in severe cases of hearing loss, as in the deaf and the hard of hearing. Yet, what is the effect on speech of differences in finer discriminatory abilities in audition? This relationship has received some experimental consideration with varied and conflicting results.

Is there a relationship between an auditory perceptive (sensory) ability and a related motor performance? Stanton (14) studied this type of relationship with the Seashore Measures of Musical Talent at the Eastman School of Music and found these tests to have prognostic value in musical performance. Since a relationship between the auditory sensory ability and a related motor performance was here found, it seems justifiable to suppose that a reduction in the auditory field essential to speech could be detected by the proper tests.

The stimulus method of therapy for functional articulatory defectives assumes a similar audio-voco-motor relationship. One of the essentials of this method is that of ear training in which period of training the correctionist endeavors to aid the defective in improvement of his discrimination between sounds, especially his defective sounds and the correct sounds (19, 223-240). Heretofore it has been assumed that an auditory deficiency in sound discrimination does exist in the functional articulatory defective. The problem then is: Do measurements on adult functional articulatory defectives demonstrate this deficiency?

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[1]Condensation of a thesis directed by Drs. Alan H. Monroe and M. D. Steer and submitted by the author in partial fulfillment of the requirements for the degree of Master of Science, Purdue University, May, 1942.

[2]The classification "functional articulatory defective" herein used includes lisping, sound substitution, sound omissions, infantile speech, slurring and other defects of distinctness of a functional nature. For the purpose of this study foreignisms and provincialisms have been omitted.

The results of experimenters have, to date, been conflicting. Travis and Davis' (17) study and Stinchfield's (16) study, in which the Seashore Measures of Musical Talent—pitch, intensity and tonal memory—were used as measures of sound discrimination, gave differing conclusions. Travis and Rasmus' (18) study and Margaret Hall's (6) study in which the Travis-Rasmus speech sound discrimination test was used, along with other procedures, as the measure of sound discrimination led to mutually opposing conclusions. These conflicting results may have come about either through (a) errors in techniques used in measurement, or (b) use of measuring instruments which were not adequate.

In an effort to answer our question the standardized tests used in the preceding studies, the Seashore measures and the Travis-Rasmus test, were applied to new experimental groups having normal hearing acuity. In addition a new speech sound discrimination test was constructed and given to these experimental groups in a further effort to seek out the differences between these groups—if any exist.

II. PROCEDURE

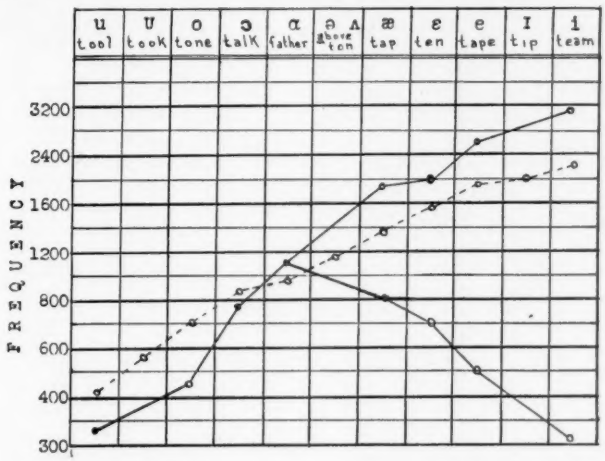
Contruction of a Sound Discrimination Test

The Travis-Rasmus speech sound discrimination test is a test involving gross sound differences and, while it may be suitable for children, a test requiring finer degrees of differentiation is necessary to detect the differences among abilities of adults. The difficulties involved in making minute differences among high frequency sounds such as are used in the Travis-Rasmus test are prohibitive to its utilization. A sound unit in which these changes can be made is necessary. Another qualification to be kept in mind is that the characteristic differences among the sounds of speech are due to differences in quality or timbre (4, 84). The sound used should be a fundamental unit of speech. Since it is the vowel that furnishes the body of the quality of spoken sound, and since the problem of the vowel is entirely a problem of tone quality or timbre (12, 113), and since it is possible to change the timbre of the wave in progressively finer degrees through the use of homophonemic vowels, the test made for this study has been constructed by using the vowel as the basic sound unit.

The test consists of five columns, in each of which there are ten pairs of vowels. Within each column there are several vowel pairs which are the *same*, the rest are *different*. The range of difficulty was obtained by varying the amount of difference between vowels within pairs. The first column consists of gross vowel differences and the difficulty progresses throughout the test, the last column consisting of differences among vowels within the same phoneme. The increase in difficulty of the vowel pairs is based on a decreasing difference in the characteristic frequency regions of vowel resonance (8, 10, 11). (See Figure 1.)

Thus in the first column of the test front vowels are paired with back vowels. These vowels involve the greatest differences in characteristic frequency regions. All pairs are matched randomly. In the second column front vowels are paired with front vowels and back vowels with back vowels, each vowel being separated from the other member of the pair by at least two frequency regions. The third column pairs adjacent vowels as they appear on Figure 1. The fourth and fifth columns pair homophonemic vowels. The order in which the sounds are arranged for the test is shown in Figure 2.

FIGURE 1. CHARACTERISTIC FREQUENCY REGIONS OF VOWEL RESONANCE.



o————o Miller's data, typical of single and double resonance vowels.

o·····o Liddell's vowel constants (energy-frequency ratios) in terms of single resonance frequencies.

In order to insure comparability of transmission of the stimuli from one test situation to another the test was recorded by means of high-fidelity radio transcription equipment. The author vocalized the sounds, attempting to keep pitch, time and intensity as constant as humanly possible.

Validation of the Vowel Test

Since this test was constructed for the purpose of testing sound discrimination ability, the best criterion for its validation is the judgment of experts. The test was administered to six staff members of the Purdue University Speech Clinic. A validation of each item was secured by having these staff members give judgment of *same* or *different* for each of the pairs of sounds they heard. This process resulted in the selection of 46 items or pairs as valid measures.

Subjects

The staff of the Purdue University Speech Clinic was used for validation of the Vowel Test as described above.

The second group of subjects included those students used in determining the reliability of the test. This group consisted of 95 male students enrolled in Speech 14 classes at Purdue University the second semester of 1941-42. This group constituted a random sample of male Purdue freshmen and sophomores, since Speech 14 is a required course for the schools of Engineering, Agriculture, Pharmacy and Physical Education at Purdue. The tests were administered to these students in their regular classrooms.

FIGURE 2. THE ORDER OF ARRANGEMENT OF THE VOWEL SPEECH SOUND DISCRIMINATION TEST.

	Column A	Column B	Column C	Column D	Column E
1.	i – i	ɛ – ɪ	u – u	i – i	e – e
2.	ʊ – ɪ	ɛ – ɛ	i – ɪ	ɪ – ɪ˧	ɪ – ɪ
3.	o – o	æ – æ	e – ɛ	e – e+	ɛ˩ – ɛ˥
4.	e – u	e – i	ɛ – ɛ	ɛ – ɛ	æ – æ+
5.	ɔ – ɛ	ɪ – ɪ	æ – ə	æ – æ	i – i(l)
6.	æ – æ	ɑ – æ	ɔ – ɔ	ɑ – ɑ̈	ɑ – ɑ
7.	ɪ – i	ɔ – ʊ	ɑ – ɑ	ɔ – ɔ	ʊ – ʊ
8.	i – o	o – o	ɑ – ɔ	o – o	ə′ – ə′
9.	æ – ʊ	ɑ – o	o – ɔ	u – u	ɔ – ɔ (dark)
10.	e – e	ə – ə	ʊ – ʊ	ə – ə′	ʊ – ʊ˩

The third major group of subjects included those in the three experimental groups. The students in these three groups were matched on the basis of their percentile rankings on the American Council Psychological Examination (1) which is taken by every student entering Purdue. The difference between matched percentiles was never greater than one decile. Since hearing acuity changes very little between the ages of 15 and 30 years (15, 291-301) it did not seem necessary to match the subjects on the basis of age. All the subjects were males within the age limits of 17 to 24 years.

The first of the experimental groups was the Untrained Articulatory Defectives. These were selected on the basis of known defectiveness of articulation. Most of them were students who had been rated as "Articulation—3"[2] in their speech examination upon entrance to Purdue. The rest of the members of this group were referred by speech instructors as students having defective articulation. In order to provide a second check on the survey ratings and the speech instructors' ratings these students read a test passage, "Arthur, the Young Rat," before the author prior to the

[2]This is a rating used on Purdue Survey and Speech examinations. A rating of "3" denotes a degree of severity in which "clinical therapy is imperative."

taking of the hearing tests. Only those with a definite articulatory defect were then retained in this group. These students had had no speech therapy. The number of subjects in this group was 13.

The second experimental group was made up of students classified as Trained Articulatory Defectives. This group, matched with the first on the basis of the Psychological Examination rankings, was a group of articulatory defectives and former defectives, who had received and were receiving clinical speech therapy. These subjects had all received at least eight weeks of clinical therapy in which the "stimulus method" of therapy was used. An essential which is attended to first in this therapy is that of "ear training." The number of subjects in this group was 13.

The third experimental group consisted of students classified as Normal Speakers. This group, matched on the Psychological Examination rankings with the other two groups, was selected from speech classes on the basis of the author's judgment that their speech was normal. A further check on these students was provided by the speech rating given them in their speech examination when they entered Purdue University. None of this group was rated as an articulatory defective of any degree on this entrance examination. This group also consisted of 13 male subjects.

TABLE I. COMPARISONS OF THE RELIABILITY COEFFICIENTS OF THE TRAVIS-RASMUS TEST, SEASHORE MEASURE OF TIMBRE AND THE VOWEL TEST.

Test	r	PE_r
Travis-Rasmus Speech Sound Discrimination Test	.72[1]	.07
The Seashore Measure of Timbre	.74[2]	.02
The Vowel Speech Sound Discrimination Test	.69	.04

The experimental group consisted then of three subgroups: the Untrained Defectives, Trained Defectives and Normal Speakers, numbering 13 each. The total number in the experimental group was 39. None of the individuals within the groups was informed that he had been classified in any particular category. The students were tested in heterogeneous groups; they were intermingled in the seating arrangment in the testing situations.

Reliability Determinations

To the random sample of 95 students in Speech 14 used in testing the reliability of the Vowel Sound Discrimination Test this test was given two times. In administering the test the same instructions were given to this group as were given to the experimental group. Immediately following the conclusion of the first administration of the Vowel Test they were given new answer blanks and the same test was given again. Thus there was a negligible time interval between tests. Scoring was based on the number of errors.

[1]This reliability coefficient was determined by the authors of the test (18).

[2]This reliability coefficient was established by the authors of the 1939 revision of the Seashore Measures of Musical Talent on a group of 300 subjects (13).

The range of scores (number of errors) was from 0 to 15. The mean score on the first test was 4.33 with a standard deviation of 2.52. The mean score on the retest was 4.75 with a standard deviation of 2.61. The coefficient of reliability obtained, using this test-retest method, was .685±.036. This reliability coefficient very nearly approaches the .70 level which is accepted by some authorities as being reliable for group testing (7, 193-211). While this coefficient is insufficiently high to make conclusive statements therefrom, it does compare favorably with those of tests used heretofore for this type of measurement. The reliability coefficients of the three tests are presented in Table I.

Administration of Tests

To the experimental groups the following tests were given: the New Standard Western Electric 4C Audiometer test, Columbia Record No. KS—10087; Recorded Vowel Speech Sound Discrimination Test, given two times; Recorded Travis-Glaspey Speech Sound Discrimination Test; Seashore Measure of Timbre.

In order to insure comparability of volume and reception to the subjects irrespective of room acoustics, all tests were recorded and then transmitted by means of the Western Electric 4C Audiometer. This is a group audiometer and it was used according to the Manual of Instructions (2). Each subject is given an earphone which is fitted snugly to the ear. The sound stimulus is thus constant from situation to situation and from one individual to another. Answers or responses were recorded by the subjects on a separate scoring sheet for each test. The earphone was fitted to the "better" ear which was then used for the duration of the test.

The Western Electric 4C Audiometer. The hearing acuity test was given to all subjects first and it was scored as per instructions in the manual. The purpose of this test was to detect those individuals with a hearing loss greater than the 9 db. level. The subjects having such a hearing loss were then eliminated from the rest of the tests.

The Vowel Speech Sound Discrimination Test. Following a few minutes of rest the vowel test described above was given. The students were instructed thus: "You will hear two vowels which are either the same or different. If they are the same write *S* in the column; if they are different write *D*. If you are not sure, guess." Results were recorded with pencil by the subjects on test blanks prepared for this purpose. In computing the correlations the score used was the number of correct responses.

The Travis-Glaspey Sound Discrimination Test. Since it was desired to check the results of this study against data from previous studies made with the Travis-Rasmus type of test, a form of this test was used. As the Travis-Rasmus test is too long to make it practicable to record, a shorter form of the test known as the Travis-Glaspey (3) was recorded just as was the Vowel Test. It was assumed that the reliability of the test thus given was unaffected and remained the same, .72±.07 (18). This test consists of 108 pairs of consonant and vowel sounds such as appear in the Travis-Rasmus test. Answers were recorded on scoring blanks prepared for this purpose by the Purdue Speech Clinic. In determining correlations the score used was the number of correct responses.

The Seashore Measure of Timbre. It is possible that the former experiments using the Seashore tests of pitch, intensity and tonal memory were conflicting because of selection of tests. Sound substitutions, dis-

tortions, omissions and slightings are not a matter of pitch, intensity or tonal memory. The characteristic differences among speech sounds are due to differences in quality or timbre. Thus the Seashore Measure of Timbre should offer a better measure of the discriminatory ability essential to speech. For this reason the Timbre Test A was included in this battery of tests. The odd-even reliability coefficient of this measure, corrected by means of the Spearman-Brown prophecy formula was, for adults, .74± .02, as reported by the authors of the 1939 revision of the Seashore Measures of Musical Talent on a group of three hundred subjects (13). For this test the students were given the instructions which appear in the test manual.

A retest on the Vowel Speech Sound Discrimination Test was given following the Seashore Measure of Timbre.

The entire series of five tests was administered in one sitting requiring about forty-five minutes.

III. Results

In the construction of the Vowel Test it was desired that a test be obtained which would not be subject to the same faults as previously employed tests. It was therefore necessary to construct a test which would be valid and reliable *and* measure abilities different from those measured by the other tests. By correlating scores on the Vowel Test with scores made on the other tests of sound discrimination a measure of the relationship of these tests was obtained. The intercorrelations of the three sound discrimination tests are shown in Table II. These correlations are based on the results of tests given the students in the experimental group.

TABLE II. Intercorrelation of the Three Sound Discrimination Tests.

Tests	r	PE_r	Corrected for Attenuation
Vowel; Travis-Glaspey	.21	.06	.30
Vowel; Timbre	−.04	.11	−.06
Timbre; Travis-Glaspey	.18	.10	.25

On the basis of these data we can be reasonably certain that (within the limits of the tests themselves) the tests are measuring different abilities. Since these tests have been judged by speech authorities to be measures of sound discrimination ability, they are evidently tests which measure different aspects of a complex rather than a simple function.

The results of the administration of the battery of sound discrimination tests to the three experimental groups consisting of 13 male adults each were treated by means of small sample techniques (9). The mean difference in raw scores[6] between the tests to be compared was computed and from

[6]The raw scores in these computations are in terms of the number of correct responses made in the tests.

this was determined the t statistic. The values thus found appear in Tables III, IV and V. As is shown in these tables, no statistically significant group differences were found on any of the tests used.

TABLE III. COMPARISONS OF THE MEAN SCORES OF THE "UNTRAINED DEFECTIVES" WITH THOSE OF THE "NORMAL SPEAKERS" ON THE THREE TESTS OF SOUND DISCRIMINATION.

	Vowel	Timbre	Travis-Glaspey
Untrained Defectives	40.08	45.69	94.23
Normal Speakers	41.08	43.46	91.07
Mean Difference	1.00	−2.23	−3.16
t statistic	.95	−1.44	−1.49
Significance level	30%—40%	10%—20%	10%—20%

TABLE IV. COMPARISON OF THE MEAN SCORES OF THE "UNTRAINED DEFECTIVES" WITH THOSE OF THE "TRAINED DEFECTIVES" ON THE THREE TESTS OF SOUND DISCRIMINATION.

	Vowel	Timbre	Travis-Glaspey
Untrained Defectives	40.08	45.69	94.23
Trained Defectives	41.46	45.23	93.76
Mean Difference	1.38	−.46	−.47
t statistic	1.79	−.35	−.34
Significance level	10%	70%	70%

TABLE V. COMPARISON OF THE MEAN SCORES OF THE "TRAINED DEFECTIVES" WITH THOSE OF THE "NORMAL SPEAKERS" ON THE THREE TESTS OF SOUND DISCRIMINATION.

	Vowel	Timbre	Travis-Glaspey
Trained Defectives	41.46	45.23	93.76
Normal Speakers	41.08	43.46	91.07
Mean Difference	−.387	1.77	−2.69
t statistic	−.558	1.59	−1.15
Significance level	60%	10%—20%	30%

IV. SUMMARY AND CONCLUSIONS

Three tests of sound discrimination, the Seashore Measure of Timbre, the Travis-Glaspey Speech Sound Discrimination Test and a new Test of Vowel Sound Discrimination, were applied to three experimental groups having normal hearing acuity: untrained functional articulatory defectives, functional articulatory defectives who had received clinical therapy, and normal speakers. Using small sample techniques it was found that: (a) untrained defectives did not differ significantly from normal speakers in sound discrimination ability as here measured; (b) trained defectives did not differ sig-

nificantly from untrained defectives in this ability; and (c) trained defectives did not differ significantly from normal speakers in this ability. Thus, the assumption that this type of auditory deficiency exists more frequently in adult functional articulatory defectives than in adults with "normal speech" is one which the present investigation has failed to substantiate.

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NEWS AND ANNOUNCEMENTS

(Continued from Page 346)

During the week of September 25-29 the University of Minnesota Speech Clinic conducted its 1944 fall survey of all incoming freshmen with an increase in enrollment of 31 per cent over the 1943 fall quarter enrollment. An approximate 2340 freshmen were examined by a staff of nine speech clinicians assisting Dr. Bryng Bryngelson, director of the speech clinic. A five-minute interview is held with each student at which time speech defectives, personality cases, those with difficulties in reading and spelling are diagnosed and special help is recommended. This survey was first conducted at the University of Minnesota last fall and has been permanently instituted. A small fee is now added to the incidental fee of each student, making the clinic services available to the entire student body.

The Minnesota Speech Clinicians were privileged to have Dr. Wendell Johnson, director of the speech clinic, University of Iowa, speak at their 1944 convention held on October twenty-sixth and twenty-seventh in St. Paul. Dr. Johnson spoke on "The Psychology of Stuttering." A business meeting was held on the twenty-sixth.

PERSONALS

Dr. Walter Hughson suffered an attack of spinal meningitis and died September 13, 1944. He was 53 years old.

As director of the otological research laboratory in the Memorial Hospital, Abington, Pennsylvania, Dr. Hughson had made outstanding scientific and clinical contributions to the fields of otology and hearing conservation. He was a member of the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology. A native of Orange, New Jersey, he was graduated from Johns Hopkins Medical School, where he later served as associate professor of otology. He assumed the directorship of the Abington laboratory in 1935.

Dr. Hughson was also an associate in otolaryngolgy at the Graduate School of the University of Pennsylvania, as well as consultant to the Bureau of Child Hygiene of the United States Public Health Service, member of the American Rhinolaryngology and Otology Society, the American Otology Society, and the Philadelphia Medical Society. His interests were broad, his abilities highly refined, and his influence was of a permanent character.

Since the outbreak of the war, Dr. Hughson had assumed a great many duties in addition to his regular work. For some time preceding his death he directed the personnel of the United States Naval Hospital at Philadelphia in the techniques of examining deafened patients. Attending physicians attributed his illness and death largely to overwork. He will be numbered as one of the most serious war casualties among the members of our profession.

(Continued on Page 362)

THE ROLE OF THE COLLEGE AND UNIVERSITY HEARING CLINIC[1]

MIRIAM D. PAULS, M.A.
Indiana State Teachers College

I.

Recent years have seen great advances made in the field of audition. Contributions of research workers in the interrelated areas have served not only to focus attention upon the problem of hearing, but also to point up the limitations in our present knowledge. Vast areas still need to be explored and these offer challenge to the physicist, the medical man, the physiologist, the psychologist, and the hearing therapist alike. There is an imperative need to coordinate research findings and to employ them in carrying out broad hearing programs not only for our military, but also our civilian personnel.

The incidence of aural casualties in the armed forces, and the subsequent investigations into the causes and effects of acoustic insult, are serving to make both the specialist and the layman aware of the urgency of the problems of deafness. These are not new problems, however. Their importance and scope have long been recognized by interested organizations and individuals, who have advocated hearing conservation programs as a means of meeting the situation. The American Society for the Hard of Hearing and the Committee on the Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology have directed much of the thinking. Events are forcing us to slough off the inertia that accompanied a fatalistic attitude regarding hearing impairments and to pursue a more positive approach. Certain progressive states and local communities have undertaken hearing conservation programs to greater or lesser degree.

These programs owe much to the physicist, for it has been the development of the modern audiometer that has enabled us to determine accurately the incidence, type and degree of hearing impairment in our population. Surveys made in our public schools show that from five to forty per cent of a school population may have a hearing impairment. This wide spread can be explained by variations in testing techniques, the criteria employed to determine the loss, and by the differences in the economic status and general health of each particular group. Well informed medical men are cooperating in follow-up programs, for there is strong evidence that early detection of

[1]Read before the Acoustical Society of America, May 12, 1944, as part of a Symposium on the Correction and Prevention of Hearing Impairment. Miss Pauls is Clinical Supervisor of Hearing Therapy in the Special Education Clinics, Indiana State Teachers College, at present on military leave serving as Lieutenant (jg) in the United States Navy.

slight hearing impairments, followed by prompt medical treatment, can prevent or ameliorate approximately ninety per cent of the hearing losses of children. These figures sharply point up the need for hearing conservation programs in every community.

Such programs demand the intelligent support of an enlightened public. Any adequate hearing conservation program must have as its foundation four basic objectives: detection, medical attention, rehabilitation and prevention. The efforts of medical men, educators, social service workers, and research men must therefore be coordinated to make a cohesive unit. It would seem that college and university hearing clinics are in the position to serve as coordinating agencies. They have the scientifically trained personnel to envision the needs of the entire program and the facilities to cope with the detection and rehabilitation phases. Furthermore, within the institutions themselves are the many different departments to help guide and supplement the program. By their very nature, colleges have broad affiliations which cut across all areas. These contacts enable the college clinic to correlate the different services in the community that should be made available to the deaf and hard of hearing. The training and experience of the staff enable them to appreciate the significance of the research in different areas and to use it in the development of sound therapeutic procedures. Not to be forgotten is the profound influence exerted by the colleges and universities through training future workers in the field. Perhaps the above points can best be illustrated by describing the operation of the clinics with which I am affiliated.

II.

The Special Education Clinics of Indiana State Teachers College are composed of four clinics offering services in five different areas: speech, hearing, reading, sight conservation and psychological adjustment. Each division is headed by a supervisor and all are closely coordinated by the director. The clinics have a fourfold purpose: (1) the training of qualified therapists; (2) clinical services providing diagnostic and remedial treatment for handicapped individuals; (3) consultant services for educators, medical men, parents and social service workers; and (4) research.

The hearing program in Indiana has been greatly facilitated by a law which was placed upon the statute books in 1941. This law provides for the annual testing of the hearing of school children and appropriate follow-up measures. It supplements the Special Classes Law of 1927 which provides for state aid to defray the excess cost of classes for physically handi-

capped children. Our teacher training program is constructed to qualify our students for the speech and hearing therapy licenses required by the State Department of Education. The core curriculum provides a broad general background in education, psychology and science, and highly specialized instruction in theory, methods and techniques of treating the acoustically handicapped. Much time is devoted to directed observations, followed by clinical practice under close supervision. This practice is designed to give the student experience in all phases of the hearing program with all ages and types of acoustically handicapped persons. This experience includes testing the hearing of the children in a typical school system, interpreting results, and making recommendations to superintendents, teachers and the community, as well as executing all phases of a rehabilitation program: audiometric testing, speech reading, the fitting of aids, acoustic training, speech and voice improvement, psychological testing and vocational guidance.

The facilities and staff of the hearing clinic are at the service of any deaf or hard of hearing person who may care to take advantage of them. The patients range from preschool-age children to adults. We anticipate the inclusion in our rehabilitation program of numbers of service men and women as they are released by the armed forces and referred by the Veterans' Administration and State Department of Vocational Rehabilitation.

The typical clinical procedure is as follows. When the patient enters the clinic, he receives a series of careful audiometric tests by both bone and air conduction on a pure tone audiometer in order to determine the character and severity of his loss. A careful case history, covering pertinent sociological, psychological, and medical data, is obtained. A comprehensive file is kept for every patient. This file includes not only data obtained by clinical examinations together with recommendations and notes on treatment, but also reports sent in by the otologist, social service worker, the school, the County Welfare Department, the State Department of Rehabilitation, etc. This is done not only to illuminate the problems of that particular individual, but also to accumulate data that may prove to have significant research value in the future. If the patient has not been referred to the clinic by an otologist, he is required to seek immediate medical advice, for the otological diagnosis and prognosis, along with the audiometric findings and case history, serve as a basis for rehabilitative measures.

III.

Every patient with a hearing impairment of 25 decibels or more is encouraged to take speech reading. Early speech reading instruction relieves strain and enables a patient to cope

with a progressive loss. The needs of the patient determine whether group or individual instruction is advisable. The patient is taught to use all stimuli that may "enable him to understand language by watching a speaker without fully hearing, or, if need be, without hearing at all."[2] He is trained to observe auditory, visual, kinesthetic and situational clues such as objects, gestures and facial expression. The development of empathic response is felt to be very important. We find that the greatest progress is made in a relaxed, casual atmosphere with an abundance of interesting material couched in natural conversational language. Drill is given on the vocabulary that the individual may need in his particular life situation. For instance, we now have in the clinic a profoundly deafened pathologist who is a brilliant German Jew. His lessons have to be individualized and are loaded with medical and technical phraseology that he must understand in his daily contacts in the hospital. His splendid progress can be attributed largely to the confidence he has developed in his ability to cope with situations that are most vital to him. On the other hand, we have a group of ten middle-aged adults who make an excellent class because of their similar loss and common interests. They profit from the opportunity to lip read each other.

If the patient has a forty decibel loss or more in the better ear, he is encouraged to consider a hearing aid. Through the cooperation of the manufacturers, we have on deposit representative models of the different hearing aids that have been accepted by the Council on Physical Therapy of the American Medical Association. The laboratory is so equipped that an aid can be scientifically fitted to compensate best for the type and degree of loss of each individual. Research workers are agreed that the aid best suited to each person can only be determined by accurately attenuated speech reception tests under laboratory conditions.

First, the patient's threshold level for speech intelligibility is found by administering a speech reception test over a loudspeaker to the unaided ear. Then with the patient wearing the various aids which *should* compensate for his loss, the *actual* threshold gain for each aid is determined for that particular patient. Evaluating the results of these tests in light of additional subjective factors, we are able to guide the patient in the selection of the aid that is best for him. He is given the name and address of the dealer handling that aid. At the same time a letter of instruction is sent to the dealer advising him of the referral and instructing him which ear is to be fitted and

[2]Bunger, Anna. Speech reading: Jena Method. Danville, Ill.: Interstate Publishing Co., 1944. Revision of mimeographed edition, "The Ypsilanti Adaptation and Extension of the Jena Method of Speech Reading," Ypsilanti, Mich., 1932.

the model of aid to be supplied. The patient is scheduled for return visits to check the fit and to receive all help necessary in adjusting to the aid selected.

It has been established that acoustic training, or learning to discriminate amplified speech, is highly advisable. It is imperative when the loss has been extensive over a long period of time, or when there is a sudden, profound loss so that the patient must learn an entirely new auditory pattern, or when deafness is embryonic, or occurred at such an early age that speech and language have not been established.

Speech and voice improvement are stressed in order to overcome the problems that are peculiar to the hard of hearing. When speech is not distinctly heard, the voice tends to take on a monotonous, unpleasant quality and the speech becomes "thick." Prompt speech work with the suddenly deafened individual will help to prevent the gradual deterioration of his speech and voice. The greater the loss the greater the need for such training.

A battery of psychological tests may be administered to determine the patient's intelligence, educational achievement, aptitudes and personality adjustment. These tests help determine what other recommendations should be made. In dealing with children conferences are held with the parents and with the teachers, and they are instructed in helping the child adjust in the regular classroom and at home. Special tutoring may be advisable in certain school subjects. Then as the child becomes older he receives vocational guidance, training and placement.

The State Department of Rehabilitation gives splendid cooperation with any case sixteen years of age or older that presents a vocational problem. Costs of these services are paid by the State Department of Rehabilitation and cover vocational guidance, financial help for further training, vocational placement and follow-up work. One-half of the cost of a hearing aid may be borne by the state.

IV.

The high incidence of acoustic handicaps in our population presents a challenge to workers in many specialized fields. The establishment of broad hearing conservation programs with adequate provisions for detection, medical attention, rehabilitation and prevention can only be insured by the intelligent cooperation of the physicist, medical man, physiologist, psychologist, hearing therapist, educator and the lay public. The college and university hearing clinics are prepared to give whatever support may be required to accomplish these aims.

NEWS AND ANNOUNCEMENTS

(Continued from Page 356)

Dr. Sara Stinchfield Hawk has been appointed visiting associate professor in psychology at Scripps College, Claremont, California. She is also continuing as part-time psychologist at Polytechnic Elementary and Junior High School in Pasadena. In both positions she is speech consultant for cases requiring assistance.

Lt. (j.g.) Miriam D. Pauls has been assigned to the Philadelphia Naval Hospital, where she will be in charge of the educational program for the training of teachers of lip-reading and acoustic re-education for handicapped naval personnel. Lt. Pauls is on a military leave of absence from Indiana State Teachers College. Her position as supervisor of hearing therapy in the special education clinics is being filled by Miss Florence Olsen.

Dr. Ruth Clark, of Salt Lake City, Utah, conducted the speech clinic at the University of Southern California during the past summer.

Miss Elsie Edwards is now traveling hearing tester and consultant for Indiana State Teachers College, Terre Haute, Ind.

Dr. Ernest Henrikson has left the University of Denver to become associate professor of speech at the University of Colorado at Boulder, where he will devote his time primarily to work in speech pathology.

Captain Jon Eisenson has been assigned as assistant chief clinical psychologist, Classification and Replacement Branch, the Adjutant General's Office. His work is concerned with the direction and supervision of clinical psychologists who have been assigned to duty in Army medical installations both here and abroad.

The item concerning Miss Genevieve Arnold which appeared in the September issue of the *Journal* should have read: Miss Genevieve Arnold, formerly doing graduate work in child welfare and speech pathology at the University of Minnesota, is now a teacher of speech at the University of Hawaii.

Dr. Jeanette O. Anderson, formerly director of the speech clinic, Purdue University, has accepted a position as associate professor of speech and director of the speech clinic at Louisiana State University.

Friends and associates of Lt. Eugene Hahn, formerly of the University of Southern California and later assistant professor of speech pathology at Wayne University, will be shocked to hear of his sudden death at Newport, Rhode Island, October 29, of pneumonia.

Lt. Hahn received his Ph.D. in speech pathology in 1941, had studied at the University of California and State University of Iowa, and was appointed to the staff of Wayne University in 1940, where he was teaching when he entered the service of his country. He was stationed at the Naval War College, Newport, Rhode Island, and held the rank of lieutenant at the time of his death. He had recently been advanced to the rank of associate professor at Wayne and expected to return there on completion of his military service. Mrs. Hahn was closely associated with him in clinical speech work.

Lt. Hahn, a Fellow of the American Speech Correction Association, was a thorough, untiring worker, enterprising and original, the author of *Stuttering: Significant Theories and Therapies*, and a contributor to several professional journals. He was a man of unusual promise, and his death is a great loss to the profession. *(Sara S. Hawk.)*

ABSTRACTS OF CURRENT ARTICLES

MARY HUBER, *Editor*
Brooklyn College

Belgum, David. Stuttering. *Hygeia*, 1944, **22**, 346-347 and 391.

A twenty-one-year-old pre-theological student at the University of Minnesota evaluates his own experiences in learning to overcome his resistance to an objective attitude toward his stuttering. He outlines briefly and interestingly the therapy practiced in the speech clinic at the University of Minnesota. The "know thyself" technique designed to help the stuttering person achieve objectivity is considered along with a neurological approach to the problem. The author's encouraging reports of his own success in learning to handle his stuttering will be particularly appreciated by other college students who are struggling with this problem. The article is further recommended to parents of children who stutter. *(Abstracted by Melba Hurd Duncan, Brooklyn College.)*

Curran, F. J., and Schilder, P. Paraphasic signs in diffuse lesions of the brain. *J. Nerv. & Ment. Dis.*, 1935, **82**, 613-636.

These authors warn against considering aphasic speech disturbances merely from a structural point of view and separating them strictly from psychogenic speech disturbances which occur in cases of neurosis and schizophrenia. The amount of impulses may deeply influence the total picture of paraphasias. A decrease of impulses is characteristic of the motor aphasic, while in sensory aphasia there is an increase of impulses. The authors cite Kleist's term, *paralogia*, in which, instead of the correct representation, a wrong word is reproduced or only a part of it comes into consciousness, or else the representations are fused. This disturbance, which is akin to paraphasia, is a disturbance in the process of thinking and representing before the final verbal formulation is made. Such difficulties occur in connection with temporal and occipital lesions of the brain cortex. Verbatim reports and comparisons of the paraphasic symptoms in schizophrenics and cases of diffuse lesions of the brain taken from the authors' own cases are presented to illustrate their propositions. *(M.H.)*

Eustachius, Bartholomaeus. Epistle on the organs of hearing. Translated by Grant O. Graves and Maurice E. Galante. *Arch. of Otolaryngol.*, 1944, **40**, 123-132.

This "epistle" was dedicated to Francis Alciatus, bishop of Milan, during the reign of Pope Pius IV.

Beginning with a discussion of the organs of hearing as first "carelessly described by the philosophers and physicians," Eustachius presents a critical analysis of the various theories and discoveries out of which developed his own concept of the function and structure of the hearing mechanism. It is presented in the quaint formal conversational style of the period, and the many allusions to other scholars and investigators give this treatise great historical value.

Photostatic copies of the original work accompany the translation. *(Abstracted by Arthur Secord, Brooklyn College.)*

Guttman, Eric. Aphasia in children. *Brain*, 1942, **65**, 2, 205-219.

Thirty cases of cerebral hemisphere lesions in children were examined with a view to comparing with adult cases the frequency, clinical picture, and prognosis of acquired aphasia in children. In this group aphasia occurred with the same regularity as in adults. In all cases under ten years the clinical picture is uniformly that of diminished speech production, with dysarthria and telegraphic style in the recovery period; this is equally true of cases with frontal and temporal lesions.

Some cases of aphasia which were submitted to intelligence tests showed very little, if any, impairment. It is suggested that intellectual retardation in certain cases is the result of the brain damage rather than the aphasia. *(M.H.)*

Hanfmann, E. Approaches to the intellectual aspects of personality. *Trans. N. Y. Acad. Sci.*, 1944, **6**, 229-235.

In a picture-completion test devised by Healy, two-thirds of the patients with organic brain pathology and one-third of the schizophrenic patients showed incongruous placements which were practically absent from the completions by the normal group. All of the incongruous completions showed a disregard of spatial relationships.

The results in a sorting test devised by Ach and modified by Vigotsky showed not only an impairment of conceptual thinking in schizophrenic patients and patients with organic brain pathology, but also differences in the patterns of intellectual performance between subjects of different educational levels and between men and women of high educational level.

In a case of brain pathology produced by injury to the head, the patient was able to use and understand language only in connection with concrete objects and situations which were immediately present. He was unable to recognize and name isolated objects, or to recall episodes, or to apprehend a simple story.

It is concluded that the loss of cognitive frames of reference leads to changes in total behavior, and that it is hardly possible to isolate the cognitive functions from the rest of personality.

The case of concretization of behavior due to damage of the brain cortex is to be reported by E. Hanfmann, M. Rickers-Ovsiankina, and K. Goldstein in *Psychological Monographs. (Abstracted by William J. Temple, Brooklyn College.)*

Huber, Mary W. All communication cut off. *Tomorrow*, 1944, **4**, 24-27.

This is a published version of an address presented on July 13, 1944, at a rehabilitation institute conducted at the University of Wisconsin by the Rehabilitation Division of the Wisconsin State Board of Vocational and Adult Education. Avoiding technical terminology as much as possible the author discusses the interrelationship of physical, psychological, social and linguistic problems in the rehabilitation of the brain-injured patients. The article should be helpful to workers in other branches of rehabilitation than speech who may sooner or later become involved with the problem of aphasia. *(Abstracted by Marion Robinson, Wisconsin.)*

Johnson, Wendell. Research program in language behavior. Development of formulations and procedures consistent with theoretical structure of general semantics. *Papers from the Second American Congress on General Semantics*, 1941. Edited by M. Kendig, Institute of General Semantics, Chicago, 1943.

In this paper presented at the Second American Congress on General Semantics, Johnson reports succinctly on the first three years of a research program at the State University of Iowa. The program is concerned with the "relatively comprehensive study of language behavior" and with the development of investigative procedures congruent with the theoretical concepts of the general semanticists.

Johnson briefs his own studies and projects undertaken by some of his graduate students at Iowa in the years since this program was inaugurated in 1939. The work of Johnson, Tuthill, Knoche, Gallant, Moore, Skalbeck, Schafitz, Chotlos, H. Fairbanks and Mann has been directed toward the evolution and testing of measures and methodologies to be employed in subsequent studies in language behavior scheduled as a part of this new research plan. Among these measures are the EAI (extensional agreement index); IAI (intensional agreement index); ECI (extensional conformity index); ESI (extensional synonymity index); TTR (type-token ratio). Some of this research has been based upon hypotheses postulated by G. K. Zipf, *The Psychobiology of Language* (New York, Houghton-Mifflin, 1935).

With the development of these measures, Johnson feels that further research in general semantics may now be undertaken and that "what such a program as this should accomplish in ever increasing degrees is a more adequate language for talking about language, and therefore a heightened consciousness of the process of abstracting, with the implied advantages for individuals and social groups." *(Abstracted by Jeanette Anderson, Louisiana.)*

Yates, A. L. Sudden deafness. *Canad. Med. Assn. J.*, 1944, 51, 240-245.

Sudden deafness is rarely caused by conditions which imperil life. Two cortical hearing centers are described. The one, which lies in the anterior third of the first temporal convolution, on its outer surface, is supposed to deal mainly with the appreciation of low tones; the other which lies on the upper surface of the temporal lobe beneath the insula is known as Flechsig's auditory nucleus, and deals with high tones. Superficial lesions which affect these centers apparently produce a state in which the patient cannot understand the words addressed to him, but speaks normally. Deep or subcortical lesions produce a state in which the patient can neither understand speech nor remember words, and accordingly speaks gibberish. The author has seen both types of auditory aphasia in patients suffering from ruptured internal meningeal artery, and one other case suggesting a diagnosis of thrombosis of the Sylvian artery. The auditory radiations leading from the auditory nuclei to these centers are affected in every case of hemorrhage into the internal capsule.

A few cases of temporary total deafness which were preceded by an epileptic seizure which began with a prodromal aura of a sound have been reported in the literature.

The commonest pontine lesion to affect the hearing is a thrombosis of the posterior inferior cerebellar artery. The signs are: Dilatation of the pupil, paralysis of the vocal cord, anaesthesia of the face to heat and touch, total nerve deafness, and marked vertigo. These are all on the same side as the lesion.

The findings of Page Nortrington on fifty-two cases of intracranial tumor are cited with the statement that considerable hearing impairment was unusual except in those of the cerebello-pontine angle. Changes in the internal ear have been reported as due to increased intracranial pressure.

The auditory nerve may be divided in fracture of the skull producing total deafness. In cases of meningitis or basal hemorrhage when the blood leaks into the perilymph there may be a sudden onset of deafness. Sudden deafness may occur from hemorrhage into the cochlea. The spiral ganglion is supposed to be affected in the condition known as the Von Frankl-Hochwart syndrome in which there is intense aural pain, followed by total deafness and facial palsy.

The most important cause of sudden deafness is due to derangement of the function of the eustachian tube resulting from carcinoma or sarcoma of the naso-pharynx. A "fluttering" deafness due to clonic contraction of the tensor tympani has been observed and reported to have driven the patient nearly crazy.

Three groups of injuries resulting from noise and concussion are cited. In the first there is bleeding into or tearing of the drum membrane with low-tone deafness. In the second the drum membrane is normal and there is internal deafness with loss of high tones. In the third the deafness is said to be hysterical but the loudest sounds fail to wake the patient from the slightest sleep.

In aviation deafness the drumhead is displaced outward and if the membrane bursts the deafness tends to be permanent and affects the highest auditory scale, both of air and bone conduction. *(M.H.)*

BOOK REVIEWS

ERNEST H. HENRIKSON, *Editor*
University of Colorado

RIBBLE, MARGARET A. The Rights of Infants. New York: Columbia University Press, 1943. Pp. 110.

This little volume is a uniquely significant contribution. It deals with that fundamental problem: a rational philosophy and method of caring for the total needs of the infant. Because the physical needs have long been recognized and their care so well perfected the attempt is here made to deal with the mental or psychic needs.

The book is written in the language and idiom suited for the average lay reader and with not a little crisp humor. Its apparently simple *a priori* logic is deceptive, for it is really the result of a great deal of arduous work. An important part of it consisted of observations of six hundred healthy new-born infants in three different maternity hospitals in New York City. The responses to various types of routine care were studied. Contrasting routines were studied of infants born and cared for at home. The functional disturbances of breathing, circulation, and nutrition of some twenty prematures were also studied. Lastly, personality studies were made of a group of one hundred expectant mothers with particular emphasis on their reactions to their pregnancies and the birth of the child. The study has now been in progress for eight years; twenty children have been followed through four years of life in order to watch the development of the child-mother relationship.

The problems dealt with include among others: The right to a mother; oxygen hunger; sucking; learning to feel; pre-mental behavior; early emotional development; getting ready to think; fathers. It is tempting to restate many of the significant findings but space limits us to but a few. The fact that a baby has an emotional hunger as well as the variegated and profound physical expressions of lack of satisfaction is established in the classic style of science—the piling up of minute and accurate empirical observations.

Another point worthy of mentioning here is the establishment of the causal relation between mothering—or rather its lack—and that ancient disease of infancy—marasmus (Greek word meaning wasting away). For a very long time physicians knew that ordinary alimentary feeding was of no avail. Good results were obtained only when they treated the child by methods used in cases of shock. It remained for this study to prove most eloquently that the basis of the shock was lack of mothering or stimulus hunger in that early and vital relationship between mother and infant best described as psychobiological symbiosis. Under the influence of the era of the microscope the pediatrician tended to guard the infant against germs so vigorously that he overlooked the great dangers in isolation and stimulus hunger. Social squeamishness regarding the instinctual drives, ignorance regarding the causes of emotional dependence in children, and hardening processes prematurely instituted further contributed to misunderstanding and wrong handling of infants. The evidence on this score is also convincingly stated.

An interesting point is that although it is well known that the nervous system in the new-born is far from complete in a number of vital respects, it is not generally taken account of in the handling of infants. It is supposed that the new-born infant just breathes and takes nourishment as a matter of course. A good many infants need much stimulation and help in the promotion and regulation of these two vital processes.

The intimate connection between the oral and respiratory processes and the development of speech is of great interest to speech pathologists. They will be especially impressed by the implications of the embryo-

logical facts about the tongue and the diaphragm, the regression to embryonic functioning of these organs when the infant is suffering from inadequate mothering. We may add that these factors are essential to the understanding of certain speech disorders such as mutism and stuttering.

Aside from the fundamental understanding of the early emotional needs of the infant and their relation to his total health which can be gained from this book by both mother and pediatrician, it has special meaning for the speech pathologist and psychiatrist. In functional speech disorders and in a number of psychiatric syndromes we deal with similar phenomena such as "rigid characters," hyperkineses, postural and other anomolies in which the psychic concomitants are difficult to elicit or not elicited at all. There is a proneness to label these conditions constitutional, by which is meant that nothing is known about them save that they are inherited states and hence nothing or very little can be done about them.

This work of Dr. Ribble's demonstrates many of these so-called constitutional states in the process of formation and resolution in the first year of life, as well as their causes and treatment. If nothing else had been contributed by this work, this discovery alone would make it an outstanding contribution of far-reaching implications.

I. PETER GLAUBER

New York City

BRIGANCE, WILLIAM NORWOOD, and HENDERSON, FLORENCE. A Drill Manual for Improving Speech. Philadelphia: J. B. Lippincott Co., 1939. Pp. xxii + 246.

This book was developed by way of training foreign language students in the University of Hawaii to speak English more or less in conformity with the sound structure of connected speech in the United States. The plan and method of the book were based, at least in part, on the results of an investigation of the speech difficulties of five hundred public school pupils of Hawaii (of Honolulu?) distributed as follows: one hundred each from pupils who natively spoke Japanese, Chinese, Filipino, Portuguese, or Hawaiian. These five hundred pupils were tested "on every sound in the English language and in each position (initial, medial, and final) in which it is used." (Considering the kinesiologic and therefore the acoustic differences of sounds in isolated words from sounds in connected speech—as illustrated at least by phrases and sentences—I should want to know which method was used in the testing.)

In view of the severity of the general problem of English speech improvement in Hawaii, extensive funds were obtained for investigation and experimentation. An experimental procedure was adopted to find the relevent facts involved in the inadequate speech of Hawaii (or Honolulu). From these facts in their configurative setting, the specific speech problems were determined and analyzed. Then descriptive explanations, drills and exercises were devised by which to correct the undesirable habit patterns of the public school pupils and of the students of the University of Hawaii.

The authors found that in learning English speech, Orientals are "faced with *more than thirty new or conflicting sounds*, plus a general consonant obscuration, plus, also, rhythm patterns that are more fundamentally different from English than are those found in" other languages (p. viii). Their conclusion was that "these conflicts include practically all that are found in other civilized languages, and *the general Oriental obscuration of the sounds of English includes substantially all obscurations found among native-born Americans with inadequate speech*" (p. viii). (The italics are by the reviewer.) The italicized portion makes the direct practical application to speech correctionists and teachers of speech improvement throughout America who are looking for better aids to their teaching.

The book is organized around the dynamic nature of the speech process. This fact should make its material of more than ordinary value in developing new habit patterns. Consequently Part One, Basic Drills, contains drills for improving speech from the following approaches, and in the order here given: Rhythm; Consonants; Vowels, Diphthongs, and Triphthongs; Combinations of Two Consonants; Combinations of More Than Two Consonants; Vowel Drills. The instructions and drills for these approaches occupy 146 pages. Then follows Part Two: Reading Exercises for Drill on Rhythm and Articulation (a total of 71 pages divided into Consonant Exercises, Vowel Exercises, and General Reading Exercises). An Appendix includes 4½ pages of stressed and unstressed forms of words. There is an index of authors, of selections, and of topics.

In Part One, the exercises for each sound begin with a list of words containing the sound, with the related letter or letters of the printed word in italics. This is for preliminary practice of the nervous system in learning to make the sound well in short sound sequences. There usually follows a description of organ placement for making the sound in isolation, often with a palatogram for graphic clearness. Then sentences and/or phrases follow for the next stage in habit formation. The phrases and sentences are applicable to any part of the United States, especially from the high school age range upwards. Throughout the drills in Part One, standards of acceptable enunciation, articulation, and pronunciation are cited for the three major linguistic areas of the United States (Eastern, Southern, and General American). To meet the conflicting desires of a wider range of teachers, both phonetic symbols and diacritical markings are employed, with a key to each.

In Part Two, the exercises consist of well chosen passages from literature, from a few lines of prose or poetry to half pages of prose and to complete poems.

In the opinion of the reviewer, this book is especially desirable as a text in speech improvement approached both from its rhythmic and its articulatory basis. What is to me an exaggerated importance attached to words instead of to syllables, I suppose must be expected for some time yet; and the exaggerated attention to spelling was doubtless a result of first developing the book for foreign language groups. The authors are somewhat fettered traditionally by syllable division of written English as an assumed basis for syllabification in speech, instead of recognizing the separate entity of each. This causes them to go only half of the factual way when they say (p. 7) that in "the word *feeding, d* belongs just as much to the second syllable as to the first." Phonetically (which, of course, refers to the sound sequence, sound groupings, intonation, and rhythm *of the spoken word*), I take the position that [d] doesn't belong to the first syllable at all. But the authors should be complimented on going half way. In doing so, they have shown originality and limited recognition of the relevant facts.

Questionable statements and questionable stress markings are rare, and the latter usually follow the general dictionaries, even if they do not in all cases represent the facts as I have observed them and assembled them from others (e.g., *whip poor will, bob white, home guard, nineteen, diphtheria, smooth faced, half hearted*). They approve syllabics in about twenty words such as *open, often, heaven, spoken* (p. 113), but they do not say that their approval is limited to connected speech for this group of words. And I question the justification for using such a term as "the vowel-murmur" (pp. 9, 50-52, 113, 229-233) when referring to the neutral or Schwa vowel instead of classifying it as a standard vowel phoneme. They thus tacitly encourage students to think of it as something outside the system of standard English vowels. But these are very minor things when compared to the large body of valuable material in the book, and its wholesome and sound point of view.

Without reference to the Brigance and Henderson Manual but in general, I should like to close with this question: When will manuals in speech retraining begin with instructions or suggestions to teachers for making a simple examination of the psycho-biological organism for possible interference with speech correction or improvement? When will such books suggest, before speech reeducation begins, the detection and referral to the proper specialist of all cases in which a possible interference may be expected from malfunctioning dentition, chronic diseases, nervous system, endocrine system, metabolism, respiratory system, circulatory system, biochemical system, electro-chemical system, etc.? Let us hope that it will be soon.

W. ARTHUR CABLE

University of Arizona

ENCYCLOPEDIA OF CHILD GUIDANCE. Ralph B. Winn, *Editor*. New York: Philosophical Library. Pp. 455. 215 items.

Here is a volume which, in spite of certain shortcomings, should appeal to parents and teachers as a handbook of contemporary thought and information on the problem of intelligently bringing up children. From this point of view such listings as those on Classroom Guidance, Classroom Teaching, Education, Family Guidance, Family Morale, Parent-Child Relations, Learning, Lying, Play, Punishment, Quarreling, Radio and Motion Pictures, and the excellent presentation on Religious Beliefs, are clear, enlightening, and for the most part helpful. Others, such as Binet Test, Color Blindness, and Conditioning, are informative, although the first two and a number of other similar expositions are not written in a way that will make easy reading for the layman.

Two subjects in the field of speech are included. James Carrell presents in seven pages a lucid essay on speech development, covering the topic briefly but adequately for such a volume as this. The presentation is divided into three periods: (a) the prelinguistic, (b) the true linguistic, and (c) the period of vocabulary growth and progressive mastery of complex grammatical forms. The style commends itself to the speech specialist and should be easy reading for parents.

The article on speech disorders by Augusta Jellinek does justice neither to the author nor to the subject. Not too carefully written or edited, it compresses the material on about a dozen different titles into the space of three pages. The several items touched upon are mutism, hard of hearing, audimutism, aphasia, retarded or delayed speech, dyslalia, general dyslalia, abnormal nasalization, hyporhinolalia, dysarthrias, stuttering, and vocal disorders. Four of these, hard of hearing, aphasia, hyporhinolalia, and dysarthrias, are disposed of in less than twelve lines, while the exposition of retarded or delayed speech is confined to approximately one hundred words.

The book has an alphabetical table of contents. It needs a good index. There are the usual cross-references following certain items but these did not make it possible for the reviewer to locate any comments on speech which did not appear in the two special articles. Combining certain of the items under one general head would have avoided considerable duplication and repetition; for example, in the three articles, Acceleration, Gifted Child, and Superior Child. Careful editing or proof-reading would have eliminated such obvious errors as "adopting" for "adapting," and "preceding" for "preceded."

Incidentally, there is no mention of speech in the article on personality, by A. D. Mueller.

HARRY J. HELTMAN

Syracuse University

ABNEY, LOUISE, and MINIACE, DOROTHY. This Way to Better Speech. New York: World Book Company, 1940. Pp. 92.

This Way to Better Speech should prove a real help to the elementary teacher. The presentation of the phonetic sounds as well as the procedure for teaching the correct pattern of speech are interesting and free from the complicated terminology which so often frightens the classroom teacher inexperienced in the more advanced phases of speech improvement.

Each phonetic sound is presented with a simplified, at times almost over-simplified, description of its formation. Easy words are listed which have the sound in the initial and final position. Then six to eight sentences repeat the phonetic sound. These are easy to read and deal with subjects that interest children. Usually a poem or speech jingle completes the lesson.

Children in second and third grades read the material quite easily, which means that this is one of the few speech correction publications that can be placed in pupils' hands.

ILA SWANSON

Waterloo, Iowa, Public Schools

BUNGER, ANNA M. Speech Reading—Jena Method. A textbook with lesson plans in full development for hard of hearing adults and discussion of adaptations for deaf and hard of hearing children. Danville, Ill.: The Interstate. Revised edition, 1944. Pp. 136. $2.50.

Speech Reading—Jena Method is at last available in book form to the delight of those who have sought an authoritative presentation of Jena principles. The original edition appeared in 1932 in mimeographed form after five years of experimentation with the translation of Karl Brauckmann's methods of teaching speech reading by Miss Bunger and Miss Bessie Whitaker. Unfortunately this limited first edition has been out of print for a number of years. The revised edition is superior not only in physical make-up, but also in the organization and presentation of the subject matter. It clearly shows the refining process that has gone on in the past seventeen years.

The growth of hearing conservation programs, coupled with the rehabilitation programs for deafened service personnel, has necessitated an impartial evaluation of methods of teaching the deaf and hard of hearing. Workers in the field should be familiar with the ideas and techniques presented in this book, for it is a highly successful method, seemingly based on sound psychological and pedagogical principles. Jena is postulated on the belief that speech is manifested in the following forms: the audible form, the visible form, the movement form, the mimetic form (expression, posture, etc.), and gesture. Stress is placed on developing a kinesthetic awareness of speech, since that form is always complete. Thus speech feeling supplements, or may even substitute for, speech hearing.

This reviewer has observed Miss Bunger's classes and has conducted some of her own, employing the Jena method. One of the outstanding characteristics of a class taught by these techniques is the informal, relaxed atmosphere. It allows for natural, spontaneous, conversational material built around interests, rather than material primarily constructed to illustrate certain speech movements or positions. This freedom facilitates the development of a sight recognition of basic vocabulary. Not the least of its virtues is that by training all sensori-motor channels, it affords excellent articulation and voice training along with acoustic discrimination while developing speech reading ability.

Window practice (i.e., the speaker talking in a natural voice while separated from the group by a well-lighted sound-proof partition) is advocated, as it provides the necessary opportunity to practice reading the speech of all members of the class. With the sound cut off by the partition, the speaker can converse in a normal voice. This eliminates the presentation of unnatural, distorted speech patterns, which frequently result from the effort to talk below the threshold of audibility.

This volume has much to offer to all those interested in the communications area. Hearing therapists, speech correctionists, speech teachers, educators and psychologists will find not only food for thought, but concrete lesson material applicable to their own fields. The introduction by the editor, Prof. Wendell Johnson, very ably presents this point of view. This book is the first of a Special Education Series, to be edited by Prof. Johnson, which is planned by the Interstate Publishing Company.

MIRIAM D. PAULS

Philadelphia

WAR NOTES

HERBERT KOEPP-BAKER, *Editor*
The Pennsylvania State College

The Office of the Coordinator has received a number of requests for information and recommendations concerning the disposition of problems relating to veterans of World War II. It is assumed that members of the Association generally might find certain specific information useful in determining the status of their own relationship to veterans' services. The Association has established contacts with the Veterans' Administration and the Vocational Rehabilitation authorities. Both agencies have emphasized the importance of acquainting the membership of the Association with the general organization of services for veterans under Public Law 16 and Public Law 346. The present attitude of veterans' authorities toward clinical speech services is reflected by a sentence from a letter addressed to the Editor of the *War Notes*, by the Office of Vocational Rehabilitation of the Federal Security Agency:

> It is our feeling that when it can be established that a speech defect operates in a significant way to handicap a veteran either in his vocational training or on the job, such a speech defect constitutes a legal condition for reeducational attention by a specialist in this field.

Individual members of the Association have been urged to establish contacts with Veterans' and Vocational Agencies on the local level, and to assist, where possible, in the adjustment of the veterans in the community. Representative of such a relationship is one established by Dr. Martin F. Palmer with the agencies in the vicinity of Topeka, Kansas. He writes:

> I have been serving at Winter General Hospital, Topeka, Kansas, in connection with the reconditioning service on a voluntary basis once a month for some eight months. The problems that we have seen have been some traumatic cases, injuries to the face and tongue, and one or two stutterers. There have not been a great many problems, but they seem to have been deeply appreciative of what we have been able to do.

They know and we know that once a month is a very unsatisfactory substitute for the real thing.

At the local veterans' facility here, I have not had any referred cases as yet. I have been out and lectured to the staff and gone over the entire problem with them. We have, of course, in the past had a number of old cases that we have seen and worked with in connection with the veterans' facility, and have always worked well together. It's a matter of luck of course, whether this type of case comes through our local facility. I have had personal conferences with all of the local officers of the staff, and I also serve on a veterans' committee which deals with the problems of returning veterans in Wichita. The Veterans' Administration staff also serves on this committee. The old cases that we have seen in connection with the veterans' facility have been aphasic, not from war wounds but from the ordinary course of events.

We have thus provided the veterans' facility with an information service and in the past, clinical services. While we have not yet had any newly wounded veterans, that is simply a matter of chance. They will be coming this way soon. It just happens that none has arrived as yet; and when they do arrive, it has been arranged that they come to the Clinic for corrective work.

The Editor of the *War Notes* provides the following information as a general background for those members who wish to establish similar relationships with Veterans' and Vocational Rehabilitation Agencies in their states.

(1) Any person who served in the active military or naval service of the United States on or after December 7, 1941, and before termination of hostilities of World War II, as determined by a proclamation of the President or by concurrent resolution of Congress, is classed as a "veteran" of World War II.

(2) Rehabilitation refers to restoring a disabled person to his best possible mental and physical condition, and aiding him in preparing for and getting into employment.

(3) There are two bases for entitlement to benefits provided for veterans by the Government: [1] Service-connected disabilities and [2] non-service-connected conditions. A service-connected disability is one which results from a disease or injury contracted in the service and not the result of the veteran's misconduct. Non-service conditions include those due to age and disabilities not contracted in service.

(4) The Veterans' Administration has established Field Stations each in charge of a manager, who in turn is responsible to the Administrator of Veterans' Affairs, and classified as follows:

(a) Veterans' Administration regional offices, whose principal functions are administration of veterans' benefits other than hospital or docimiliary care.

(b) Veterans' Administration facilities having only hospital activities.

(c) Veterans' Administration facilities having both regional office and hospital activities.

(d) Veterans' Administration facilities having regional office functions in addition to hospital and domiciliary activities.

(e) Veterans' Administration facilities having major domiciliary activities and hospital activities.

(5) The 10 regional offices of the Veterans' Administration are located as follows: Boston, Massachusetts; Denver, Colorado; Jackson, Mississippi; Little Rock, Arkansas; Manchester, New Hampshire; New Orleans, Louisiana; Philadelphia, Pennsylvania; Providence, Rhode Island; Seattle, Washington; and Sioux Falls, South Dakota.

(6) The Veterans' Administration facilities which have straight hospital activities are located as follows: Alexandria, Louisiana; Amarillo, Texas; American Lake, Washington; Augusta, Georgia; Bedford, Massachusetts; Canandaigua, New York; Castle Point, New York; Chillicothe, Ohio; Coatesville, Pennsylvania; Dallas, Texas; Danville, Illinois; Downey, Illinois; Dwight, Illinois; Fayetteville, Arkansas; Fort Bayard, New Mexico; Fort Custer, Michigan; Fort Lyon, Colorado; Gulfport, Mississippi; Knoxville, Iowa; Lake City, Florida; Legion, Texas; Livermore, California; Marion, Illinois; Marion, Indiana; Memphis, Tennessee; Mendota, Wisconsin; Northampton, Massachusetts; North Little Rock, Arkansas; Northport, Long Island, New York; Oteen, North Carolina; Outwood, Kentucky; Palo Alto, California; Perry Point, Maryland; Roseburg, Oregon; Rutland Heights, Massachusetts; San Fernando, California; Sheridan, Wyoming; St. Cloud, Minnesota; Sunmount, New York; Tuscaloosa, Alabama; Tuskegee, Alabama; Walla Walla, Washington; Washington, D. C.; Whipple, Arizona.

(7) The Veterans' Administration facilities which have regional office functions in addition to hospital activities are located as follows: Albuquerque, New Mexico; Atlanta, Georgia; Batavia, New York; Brecksville, Ohio; Bronx, New York; Cheyenne, Wyoming; Columbia, South Carolina; Dearborn, Michigan; Des Moines, Iowa; Excelsior Springs, Missouri; Fargo, North Dakota; Fayetteville, North Carolina; Fort Harrison, Montana; Fort Howard, Maryland; Hines, Illinois; Huntington, West Virginia; Indianapolis, Indiana; Jefferson Barracks, Missouri; Lexington, Kentucky; Lincoln, Nebraska; Lyons, New Jersey; Minneapolis, Minnesota; Montgomery, Alabama; Murfreesboro, Tennessee; Muskogee, Oklahoma; Newington, Connecticut; Pittsburgh, Pennsylvania; Portland, Oregon; Reno, Nevada; Roanoke, Virginia; Salt Lake City, Utah; San Francisco, California; Tucson, Arizona; Waco, Texas; White River Junction, Vermont; Wichita, Kansas.

(8) The Veterans' Administration facilities having major

domiciliary activities and hospital activities are located at Bath, New York; Biloxi, Mississippi; Hot Springs, South Dakota; Kecoughtan, Virginia; Mountain Home, Tennessee; Wadsworth, Kansas.

(9) The Veterans' Administration facilities having regional office functions in addition to hospital and domiciliary activities are located at Bay Pines, Florida; Boise, Idaho; Dayton, Ohio; Los Angeles, California; Togus, Maine; Wood, Wisconsin.

(10) The Veterans' Administration is authorized to furnish hospitalization or domiciliary care, including medical treatment, within the limits of its facilities, and under various conditions stipulated by law and regulations respecting eligibility and preference, to persons who have served in the armed forces of the United States and are in need of such care or treatment.

(11) Artificial limbs and other prosthetic appliances may be furnished when the need is determined by the Veterans' Administration in cases where the disability is service-connected, or associated with another disease or injury necessitating such appliances. When the veteran is receiving domiciliary care, artificial limbs, orthopedic and prosthetic appliances, including repairs, will be furnished when determined to be necessary as a part of such care.

(12) Batteries, repair, and replacement service for hearing aids are provided by the Veterans' Administration for veterans who were fitted in Army and Navy Aural Rehabilitation Units or Veterans' Hospitals.

(13) Speech (lip) reading instruction and speech correction are approved services and may be included in hospital and domiciliary care "when the need for such services is established." It would appear that members of the Association must assist the staffs of Veterans' Facilities to recognize and identify speech and language disabilities whenever possible. The medical personnel of these facilities has not been in the habit of viewing speech disorders as of special significance in the total adjustment of the veteran.

(14) Veterans suffering from conditions which are "service-connected," but which do not require hospitalization, can be provided medical care which is designated "outpatient treatment" at a facility or regional office of the Veterans' Administration; or in their home, if they are unable to travel to a field station of the Veterans' Administration.

(15) The Government maintains, through the Veterans' Administration, facilities to provide hospitalization, domiciliary care, and medical treatment for disabled veterans.

(16) The conditions upon which a veteran is eligible to apply for vocational rehabilitation under the act of March 24, 1943, are: The veteran must have been honorably discharged and must have incurred, in line of duty, a disability for which a pension is payable or would be but for the receipt of retirement pay, under the laws administered by the Veterans' Administration, and must be in need of vocational rehabilitation to overcome the handicap caused by such disability.

(17) Applications for vocational rehabilitation should be made to the Veterans' Administration office nearest the veteran's home.

(18) Vocational rehabilitation will be provided for such period of time as is necessary to restore employability, but not to exceed four years. The law provides further that no course may extend beyond the expiration of six years after the termination of the present war.

(19) A person following a course of vocational rehabilitation is entitled to a leave of absence during the period, but not in excess of 30 days in any consecutive 12 months.

(20) Members of the Women's Army Corps are eligible to a course in vocational rehabilitation, inasmuch as Public Law 110, Seventy-eighth Congress, made them a part of the Army of the United States.

(21) The United States Employment Service operates a special service for veterans through its Veterans' Employment Service, which functions in each local public employment office. Veterans are registered in local offices on special cards and a special service is provided for them through State and local veterans' representatives. The United States Employment Service has established a Handicapped Division to counsel and assist persons with disabilities. The State and local veterans' representatives function as liaison officers between disabled veterans and existing services for the handicapped.

The Office of the Coordinator has prepared certain mimeographed material for the use of members in their contacts with representatives of Veterans' and State Vocational Rehabilitation officials. These materials have been approved by the Medical Director of the Veterans' Administration and by the Director of the Office of Vocational Rehabilitation of the Social Security Agency. *They are available upon request.*

PROGRAM

TENTH ANNUAL CONFERENCE
of the
AMERICAN SPEECH CORRECTION ASSOCIATION

The American Speech Correction Association will hold its 1944 convention from December 27 to December 30, in conjunction with the National Association of Teachers of Speech, at the LaSalle Hotel in Chicago.

The program for the 1944 meeting consists of two types of presentation. There are to be the usual sessions devoted to papers and scientific reports. In addition, a series of five hour-and-a-half lectures on selected subjects has been arranged. Each lecture is designated as a short course. Each will be an integrated summary of the topic, giving particular emphasis to contemporary developments and recent points of view. The purpose of these lectures is to offer Association members systematic opportunity to review materials and extend knowledge. This purpose can be served by allowing the authority presenting each lecture sufficient time to go beyond the level of analysis possible in a paper of ordinary length.

All meetings will be held in the Lincoln Room, with the exception of the Friday afternoon tea, which will be held in the Lincoln Lounge.

The program for the 1944 meeting is as follows:

Wednesday, December 27

7:30 p. m. Meeting of the officers and councilors of the Association.

Thursday, December 28

8:30 a. m. Registration.
9:00 a. m. Joint session with the National Association of Teachers of Speech.

11:00 a. m. Short Course: Speech Problems of Cerebral Palsy Cases. Martin F. Palmer, University of Wichita.
2:00 p. m. Short Course: Psychological Measures in Speech Pathology. Charles R. Strother, University of Iowa.

THE CURRENT OUTLOOK FOR SPEECH CORRECTION AND HEARING CONSERVATION
(Joint session with N.A.T.S.)
Chairman: D. W. Morris, Indiana State Teachers College.

4:00 p. m. Pennsylvania Program for Speech and Hearing. Harold Westlake, Northwestern University.
4:20 p. m. Illinois Program for Speech and Hearing. Jayne Shover, Division of Services for Crippled Children, University of Illinois.

4:40 p. m. Aural Rehabilitation in the Army. Major Edward H. Truex, Jr., Deshon General Hospital.
5:10 p. m. The Otologists' Program for Conservation of Hearing. Dean M. Lierle, M.D., University of Iowa.

7:30 p. m. Business meeting.
8:30 p. m. Committee meetings.

Friday, December 29

9:00 a. m. Short Course: Audiometry. Scott N. Reger, University of Iowa.
10:30 a. m. Short Course: Speech Rehabilitation in Cleft Palate Cases. Herbert Koepp-Baker, Pennsylvania State College.

TECHNICAL PAPERS

Chairman: Bryng Bryngelson, University of Minnesota.

1:30 p. m. Hereditary Factors in Dysphemia Among Monozygotic and Dizygotic Twin Pairs. Severina Nelson, University of Illinois.
1:45 p. m. A Semantic Study of Identification of Speech Defects. Ernest H. Henrikson, University of Colorado.
2:10 p. m. Complexity and Breakdown in Speech Situations. Clarence T. Simon, Northwestern University.
2:40 p. m. The Fear of Stuttering. Wendell Johnson, University of Iowa.
2:55 p. m. Speech Intelligibility in Naval Aviation. Lt. M. D. Steer, USNR, Naval Air Station, Pensacola, Fla.
3:20 p. m. Discussion of papers.

3:45 p. m. Short Course: Articulation Problems. Charles Van Riper, Western Michigan College of Education.
5:15 p. m. Informal Tea. Sponsored by the Chicago Speech Correction Society.
8:00 p. m. Meeting of the Executive Council.

Saturday, December 30

GENERAL SESSION: SURVEY OF SPEECH CORRECTION PROGRAMS AND METHODOLOGIES

9:00 a. m. The Cerebral Palsy Center at St. John's. Marie Orr Shere, St. John's Cerebral Palsy Center, Springfield, Illinois.
9:15 a. m. A State Auxiliary Program for Speech Correction. Frances M. Brown, Section for Crippled Children, Division of Social Welfare, Minnesota.
9:30 a. m. Expanding State Services for the Speech Handicapped. Charlotte Wells, Mount Holyoke College.
9:50 a. m. Speech Correction in an Army Aural Rehabilitation Program. Verna Allshouse, Deshon General Hospital.
10:05 a. m. Rehabilitation of Aphasic Veterans. Ollie L. Backus, University of Michigan.

11:00 a. m. Business meeting.
12:30 p. m. Adjournment.

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